MODEL AIRPLANE NEWS

THE R/C MODELING MAGAZINE

48120 July 1991

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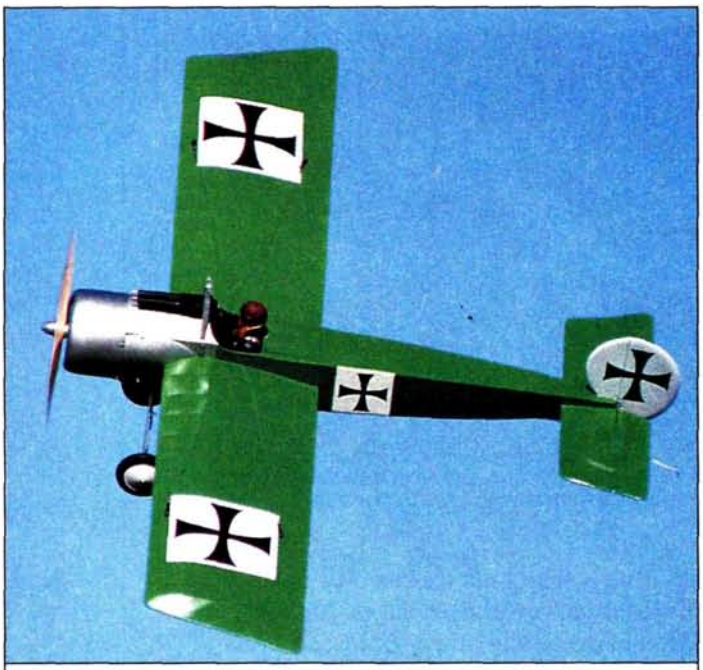
JULY 1991 VOLUME 119, NUMBER 7

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE



ON THE COVER: *center—Hobby Lobby/Graupner electric Eindecker (reviewed in this issue) in banking flight. (Photo by Clyde Geist.) Bottom right: winners at last year's Formula 1 championships. Top right: Kalt Enforcer helicopter during performance evaluation.*

FEATURES

HELICOPTER SECTION

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**,251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates are: $24.95 for 1 year (foreign, $34.95); $45.95 for 2 years (foreign $65.95). **Postmaster:** send Form 3597 to **Model Airplane News**, P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

by TOM ATWOOD

At the Toledo show, Shuriken designer Fred Baldwin shows Editor Tom Atwood a prototype tuned pipe for the new 1/2A engine.

IS aeromodeling a sport or a hobby? Those who like to tinker and build often take the traditional view that scratch-building is at the heart of aero-modeling. Look back, and you'll see great minds struggling with the challenges of free-flight, construction methods, propulsion systems, the best way to remotely actuate control surfaces, etc. We dedicate this special construction issue to the builders and designers. An 8-page section shows construction techniques—some time-tested and some novel. To get beginners started, we've included a pull-out plan of the Bee-Tween, which is easy to fly and inexpensive to build. Would you like to see more pull-out plans? Let us know! And if you view the hobby as a sport, we'll show you how to build with and repair plastic.

The recent Toledo show—the modeling "Mecca"—caps another season of trade shows we've attended in our search for new products and modeling scoops. New models included a fun-fly plane, a mid-wing sport plane, warbirds (is this *the* year for them?), giant-scale beauties (one modular, for easy transportation; another, a study in balsa construction). Fred Baldwin, the creator of the Shuriken 1/2A, is hard at work on several new engines. We'll look closely at many of these developments in future issues.

Many of you asked about our "Second Great Airplane Design Contest." Any original, unpublished design is suitable, i.e., it must not have been kitted, sold in plans form, or published as a feature article anywhere. *New versions* of a previously published full-scale plane or model are fine (they must be in a different scale or be the result of your independent research). If you took the tail feathers from one plane, the wings from another, reworked the fuselage from a third and added your own style, it qualifies as "original." You don't have to produce a construction article to be considered, but if your design is nominated as a winner, to be awarded a prize, you'll have to show you can deliver a plan, construction guidelines and a set of basic building and flight photos. See the ad in this issue for more info on the cash prizes. Please mail static and flight photos to "Design Contest," *Model Airplane News*, 251 Danbury Rd., Wilton, CT, by August 1!

MODEL AIRPLANE NEWS

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and brevity, and each must include a full name and address or telephone number so that the writer's identity can be verified. We regret that, owing to the tremendous numbers of letters we receive, we can't respond to every one.

AMA ALTERNATIVES?

The ATOM's R/C club is a small club (22 to 25 members) in central New Jersey. We've been sanctioned by the AMA for approximately 24 years. During many meetings, we've discussed the reason for belonging to the AMA.

ATOM'S R/C has looked deeply into the value and benefits of the AMA. If we listed these benefits in order of their priority, first and foremost would be comprehensive liability coverage for members, non-members and flying-site property owners. Other benefits include securing radio frequencies and working with the FCC. Items such as *Model Aviation Magazine* are less important. When the AMA considers sanctioned national contests, building a museum, paying off a mortgage early or moving to a new facility in Muncie, IN, as their top priorities, we believe they're losing touch with the grassroots clubs.

Our club has two—and only two—major concerns: we want to hold on to our flying site, and we want to prevent accidents. To keep our flying site, we must provide adequate liability insurance for the property owner. Even with strict compliance to the safety codes, accidents could occur between members and result in litigation. In the aftermath of this recent AMA insurance debacle, we're beginning to question the leadership and agenda of the AMA. It doesn't appear that the AMA knows what's important to the Sunday flier clubs, which, to us, means that membership in the AMA may not be in our best interest.

HOWARD E SHOUFFLER
Neshanic Station, NJ

Howard, I appreciate your sentiments, and your letter affords us a chance to comment on our view of the real issues. Is the AMA spending its money in a way that provides the best insurance program and best promotes

the hobby? It's desirable that such an organization lobby to protect flying frequencies, work to preserve our modeling heritage and provide other ancillary benefits to the hobby. The questions are, how good a job is the AMA doing; is it effectively communicating the bases for its decisions to the membership, and do these decisions answer the needs of most modelers?

In early March, I received a news release from Indiana's Muncie/Delaware County Chamber of Commerce. The second page of the release states, "The AMA has invested $1.5 million to acquire the site and plans to spend another $8 million in buildings and improvements over the next two to four years." The site sounds spectacular, with planned facilities that will be able to host future "AMA national championship tournaments with over 90 events requiring 14 types of flying sites." The real question, of course, is one of priorities.

How is this investment going to help the Sunday flier who isn't within driving distance of Muncie? What are the long-term benefits to the average modeler? Would some of this money be better invested elsewhere? What other priorities should be considered by the AMA? From my vantage point, I'd argue for consideration of programs that will expand the hobby, lead to more flying sites and fuel the development of more products, e.g.,

- *an action plan to introduce aeromodeling into junior high schools and high schools as an alternative to shop classes and as a vehicle to teach math and physics.*
- *an official, voluntary program under which manufacturers (it should be "self-capping" for any one manufacturer) would award modeling clubs "X" product for training "Y" number of novices to "solo" R/C airplanes. It would have to be approved by the manufacturers and orchestrated through the AMA.*
- *a plan to create country-wide self-funding flying sites that rent facilities for contests, etc., to different clubs*
- *a AMA plan to get more R/C activity in the movies and on TV; this would greatly fuel demand for R/C products and ultimately expand our ranks.*

My suggestions may not be the ultimate answers; ask yourselves whether there shouldn't be wider debate of these alternatives for resource allocation.

As for insurance, what are the options if not the AMA? Are there any insurers among our readers who would like to let us know?

(Continued on page 10)

AIRWAVES

By finding out what else may be available, we can better understand the value provided by the AMA. I invite interested readers to comment. TA

ALL IN THE FAMILY

In 1929, I bought my first issue of *Model Airplane News* in Guatemala! I built my first model in 1930, and until WW II, I read *MAN* constantly and built models. Then came the war, and after a five-year stint as a fighter pilot in the RAF and USAF, I spent a satisfying career in aviation. Occasionally, I built models, some from *MAN* plans, but most of the time I was involved with the "big" birds.

Now, I have grandchildren approaching the model-airplane age, and I'd like to help them start on the same model as I did: the Navy Fighter that appeared in a spring or summer issue of 1930. I remember it as a fine flier (it even had a chemical formula for a smoke screen). It seems to me that, with the modern supplies available, it would be an even finer model to start off with, and I think it could even be redesigned into an excellent gas-powered model.

I don't expect that you have any copies of the issue that contained this plane, but I'm hoping that you might have an old, yellowed copy in your archives, and if so, you might be able to copy the relevant pages for me.

If you can locate this issue, I'll be glad to mail you the amount that such a service would require. In any case, I wish to state my appreciation to *MAN* for inspiring a young boy to follow up his hobby and parlay it into a very satisfactory career.

ROBERT G. HALL
Winter Park, FL

Mr. Hall, I think this is the model you're looking for. It appeared on page 35 of the April 1930 issue. The only other Navy construction article was a Vought Corsair biplane in the May 1930 issue, and that's too advanced for a first-time builder. I don't have a copy I can part with, but I'm sending you a photocopy of the plans. Let me know if the aeromodeling tradition is successfully passed on to the grandchildren. CC

SMOKE OF A DIFFERENT COLOR

I'm a team member of the Broken Wings Tisselt (Willebroek, Belgium). Every year, we have an international air show with participants from different European countries. Members of our club fly in air shows for other clubs, and in exchange, other clubs fly in our show. This provides variation in airplanes, and it makes the shows more interesting.

In the last four years, we've been experimenting with colored smoke in our aircraft. Many systems have been tried, but none has worked out. The problem is that the color isn't dark enough. We had two incidents that have put a stop to colored smoke systems until a safe system is found. In the first, because of some old, failed servos, we decided to ignite three smoke pods mounted on our 15-foot Piper Cub while it was still on the ground. The first pod opened with an explosion that was followed by very concentrated green smoke. Unfortunately, no one could approach the plane for 30 seconds because it was

not known where the plane (or its prop) was in the smoke. Then the two other pods ignited, but less smoke was created and the ensuing flight had only 1 minute or so of smoke. The kids and spectators were exhilarated, but safety is more important!

Another incident occurred in France. This time, we tried a chemical mixture on two specially made Sukhois. A test run on the ground gave a positive result, but the next day, the temperature was 10 degrees lower and the green solvent wasn't burned and mixed with the exhaust as intended. The result was white smoke with a green tint. On the ground, three planes on the right and two on the left were covered with light green, rubber-like spots, as were the two aircraft that flew with the solvent. Tails and wings were covered with a green substance that felt like hardened epoxy. It had to be removed with knives (one stab had to be replaced). Fuel lines were green, fuel tanks were green, and one engine overheated. As you may have guessed, this resulted in two green pilots with green equipment.

We're searching for a small, light system that gives a minimum of 5 to 7 minutes of colored smoke that eventually turns to white smoke. We'd like to have the ability to turn colors on and off. I hope *Model Airplane News* can help us find such a system.

DE WEERDT LUCAS
Antwerp, Belgium

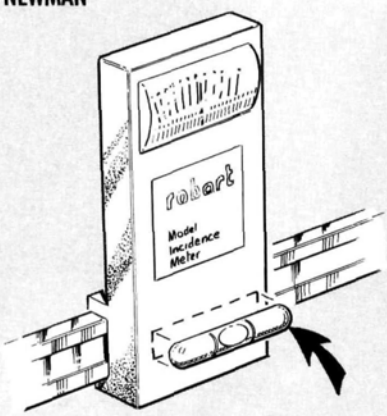
De Weerdt, since we published your brief, initial inquiry in our February issue, we've received no answers to the intriguing colored smoke problem. It seems to

(Continued on page 80)

HINTS & KINKS

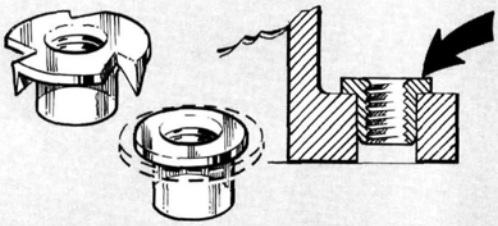
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

by JIM NEWMAN



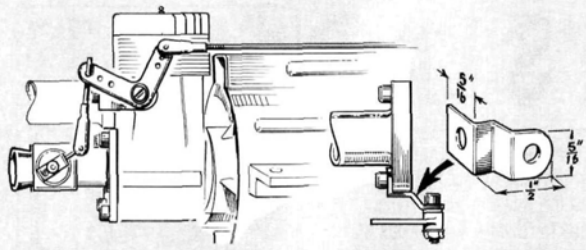
INCIDENCE-METER UPDATE

You can make your own version of a bubble-level-equipped incidence meter. If you pick up an inexpensive line level from the hardware store, you can remove the vial and attach it with CA to the front of the case. You may even be able to get a replacement vial without buying the line level. Just be sure that you have the incidence meter level and zeroed before you go a-gluing. *James D. Cassell, Niceville, FL*



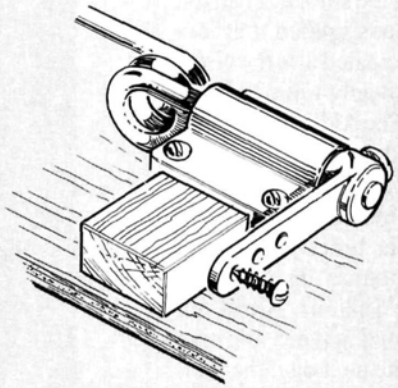
MUFFLER-THREAD REPLACEMENT

If you've stripped the threads out of a muffler, here's an effective remedy. Take a blind nut with threads matching those on the muffler bolts. With a drill, enlarge the hole in the muffler flange so it's the same diameter as the o.d. of the threaded part of the blind nut. Grind down the diameter of the nut flange, as shown, and insert it into the muffler flange from the rear. A smear of epoxy or Pacer high-temperature silicone will keep it in place. *Leonard Wyatt, Fresno, CA*



DUCTED-FAN THROTTLE LINKAGE

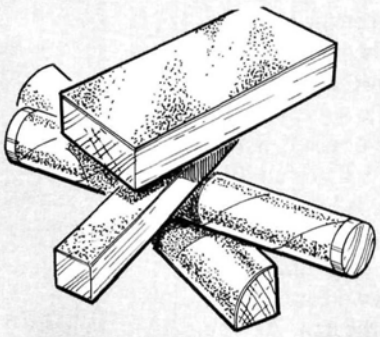
Here's a tip that will help you get that throttle linkage past the fan unit. A small steel bracket is attached underneath one of the exhaust-header bolts and carries a regular R/C bellcrank. This transfers the motion via the usual threaded pushrod, clevis and a ball joint. There are no snaking cables, so the coupling is neat and there's no wasted motion. *Ralph Salvidar, Fresno, CA*



FIXED NOSE GEAR

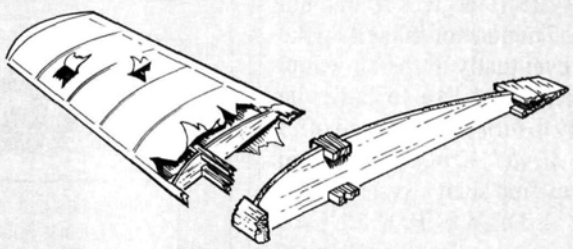
Occasionally, plans call for a fixed (non-steerable) nose gear. Here's a very easy way to construct one with the regular steerable components. Just be sure that the hardwood block has been firmly glued to the firewall.

Patrick De Maesschalck, Antwerp, Belgium



SAVE YOUR SANDPAPER

Ever wondered what to do with all those oddments of sandpaper? If you stick them to moldings, dowels and small blocks of wood, you'll soon have a collection of useful sanding blocks of all shapes and sizes. *Luca Simonatti, Prato, Italy*

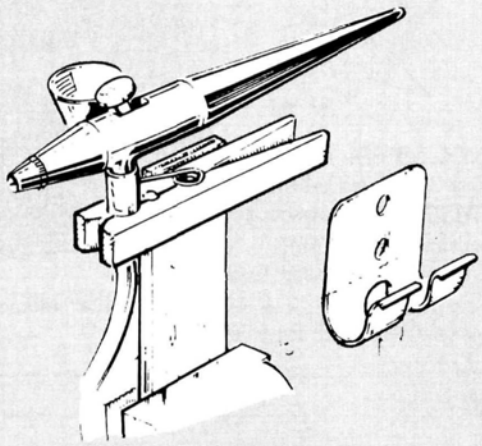


SALVAGING RIBS

If, after a wreck, you're forced to scratch-build a new wing and you've used CA in the construction, you can salvage the ribs. Saw close to each rib, leaving the spar stubs in place, and soak the ribs in a container of acetone. Seal the container with a lid, or with a few layers of plastic wrapped tightly with a rubber band. (Do this in a well-ventilated area, away from open flames.) After five or six hours, you'll find that the spar stubs have fallen off and left the ribs in perfect condition for the new wing.

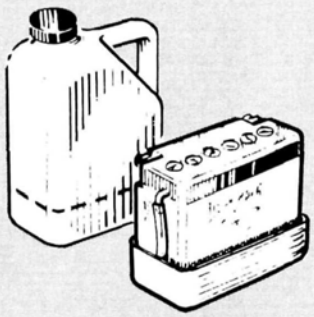
Eric Tull, McHenry, IL

HINTS & KINKS



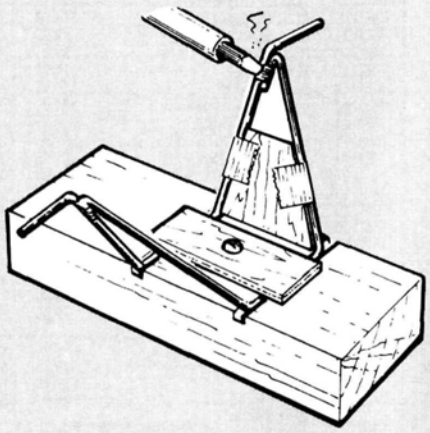
AIRBRUSH HOLDER

It's impossible to put down an airbrush without spilling paint, but you can hold it in a clothespin that's glued to ply and clamped in a vise. Professional illustrators use the bent metal clip shown.



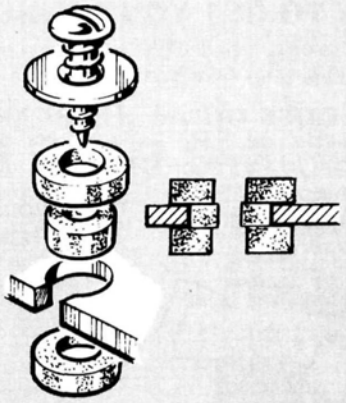
SPILL PROTECTION

If you spill battery acid, you're in trouble! Cut the bottom inch or so off a plastic container that seems to be about the right size (certain antifreeze containers are perfect), and stand the battery in that. Note how the vent tube runs down into the tray.



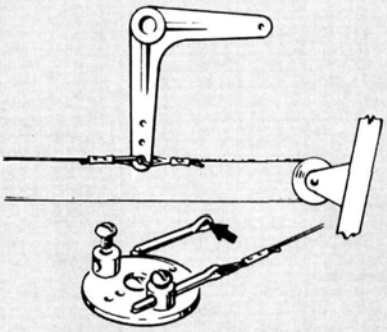
LANDING-GEAR JIG

To hold landing-gear wires firmly while you solder them, make this jig with a short piece of 2x4 in which you've sawn grooves at appropriate points. Scrap-wood templates spot-glued to this "jig" and taped to the wire hold the wire at the correct angles, and a small, thin piece of wood holds the gear on the jig. The block can be clamped or attached to your workbench with rubber cement.



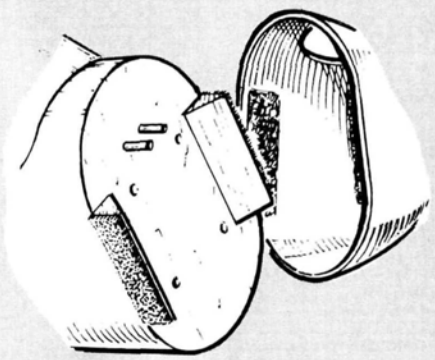
GROMMET SUBSTITUTES

Have you lost the rubber grommets you need for your servos? Slice two surgical-rubber fuel lines of different sizes to make excellent substitutes. Don't omit the smaller center slices; if the screws touch the servo flanges, they'll transmit vibration.



PUSHROD ALTERNATIVE

It's difficult to fit pushrods into slender glider fuselages, so try a closed-loop cable system instead; it gives drag-free movement and takes up very little space. A Proctor no. 110 pulley assembly on the fin post and a flexible U-control cable attached as shown do the job. (Use Goldberg's U-control Dacron thread; it doesn't stretch when heated.) The servo wheel uses two Du-Bro E-Z connectors with bent-wire cotter pins or fittings. (If you use cotter pins, be sure there are no sharp ends where the arrow is pointing.)



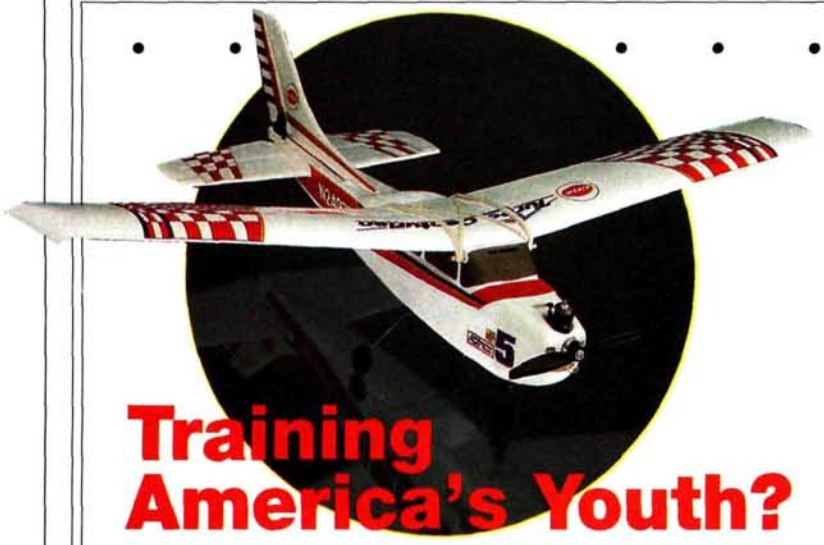
NO MORE COWL CRACKS

Vacu-formed plastic cowls tend to crack because of vibration when they're attached by screws, so why not try this? Use epoxy to glue strips of Velcro® to blocks on the firewall and to the plastic cowl. (Velcro® is available from Radio Shack and sewing-supply counters.)

AIR SCOOP

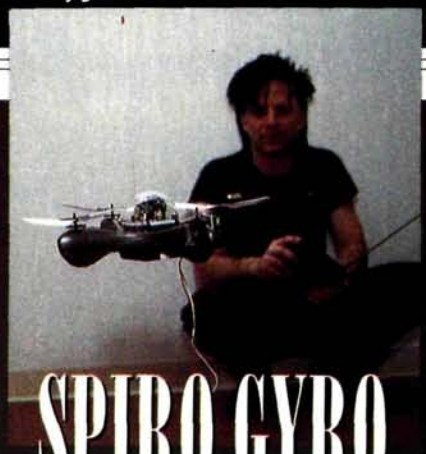
by CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find news that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!



Training America's Youth?

The Cox Turbo Centurion is a glow version of the Electric Flyboy, which has single-channel circuitry so that over-controlling is highly unlikely. Holding the transmitter button down moves the rudder just enough to make a slight change in direction, and the rudder then moves back automatically to neutral. To execute a sustained turn, a pilot must push the transmitter button repeatedly. The automatic return to neutral eliminates the likelihood of over-controlling, which is the major cause of crashes. Cox calls this system "Failsafe." We haven't tested the Centurion yet, but this system may offer the training step that has been missing for entry-level pilots. The Turbo Centurion comes with radio and Cox .020 engine installed.



SPIRO GYRO

The box in which this Gyro Saucer II comes reads, "In the image of an organic life form." I've put in a lot of stick time on this thing, and it does remind me of an airborne arachnid! This four-blade contraption, which is allegedly manufactured by a Japanese avionics company, has fully operational gyros (rate and free) under its clear dome, and this brings greater flight stability. With the exception of collective pitch, the Gyro Saucer II has the usual heli functions, including roll, pitch, yaw and throttle. We didn't have a lightweight Ni-Cd battery to load on the Saucer, so here, it's being flown by a 7.2V, 1400mAh pack with a long extension wire. This indoor R/C Gyro Saucer flies well and, as you can see, it's unique. If you like the thing, write and let me know, or contact Altech Marketing, which might soon be importing it. Because of its high-tech microelectronic gadgetry, its suggested retail price will be somewhere between $350 and $450. I think we all need one!

SHRIEKING SHURIKEN

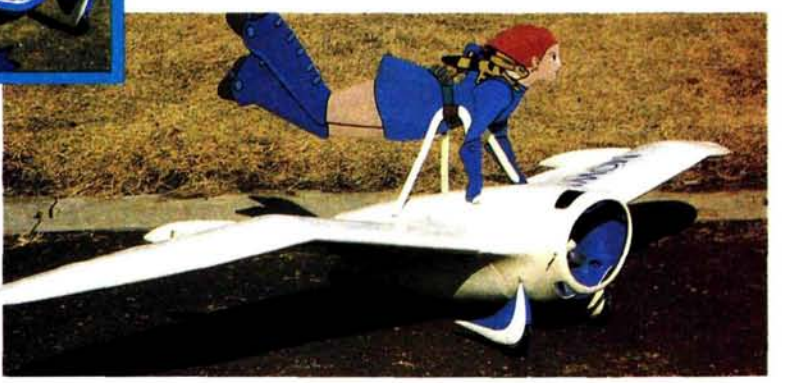
Indy 500 parts maker Fred Baldwin and his innovative, record-breaking Shuriken .050/.061 will soon have a tuned pipe specifically designed for that engine. Though the prototype shown here is made of carbon fiber, its running temperatures proved to be too high even for this material, so aluminum will be used in production models. When you consider that the Shuriken was able to produce more than 30,000rpm without a pipe, this little red monster is that much more scary.

ARF F4U

Dynaflite—pioneer of the "fun scale" concept—will soon offer the first ever all-wood ARF version of an all-time favorite: the Navy Corsair. This model is based on Dynaflite's 40-size Corsair kit, and not only will it be covered in the familiar Navy blue, but its wing will also come as a one-piece unit with all the difficult, bent-wing construction done for you. (I hope this is more than a rumor.) By the way, that's our Associate Editor, Gerry "Charlie Brown" Yarrish holding the prototype at the Toledo Show. Gerry is also associate editor of *Radio Control Boat Modeler;* no wonder he knows his starboardly from his portly sides!

air-electrolux DUCTED DAMSEL

Would you believe a flying, electric ducted wing?—that's what this Japanese experiment is. Its ailerons and elevator aren't coupled, and yaw stability is supplied by the girl with the rabbit on her back. Power comes from a 550-size electric-motor fan unit that also serves as the fuselage. Although this machine looks like a flying vacuum cleaner; it's far less noisy.



Mr. Matt's Aerobat

The new Robbe Saphir I, which was designed by World Champion Wolfgang Matt, is highly prefabricated: the wing, stab and fin sheeting are completed and sanded at the factory, and so is the fuselage. With its long tail moment and light, fully symmetrical wing and tail sections, this .60 design is aimed directly at F3A competition—the highest level of aerobatic competition for models with internal-combustion engines. According to Robbe, "The Saphir I is stable enough for any pilot who has flown an aileron-equipped model, but it's a *world-class* performer in experienced hands."

AIRSCOOP

R/C HUD

Larger protype shown.

Here's a product developed in Costa Mesa, CA, by a Ph.D. in physics and a software genius. Its electronics are completely digital, and it has an automatic pilot and a heads-up display (HUD). It even provides audible warnings and other information. The display will give you a heading, keep you level and automatically give your altitude, air speed and heading. There's an artificial horizon and a turn-and-bank ball that always points to the ground; it "dead centers" at the bottom and slides from side to side when you turn and bank. All the information you need to fly is displayed on a television monitor.

According to its designer, the system should be available before the end of the year for less than $1,000. It will be complete with camera and transmitter, and you won't need a receiver. You don't equip your TV to receive the signal: any old TV will work. For more information, contact Cliff Rausin, Condor R/C Specialties, 1733 Monrovia Ave., Unit G, Costa Mesa, CA.92627, or call (714) 642-8020; Fax: (714) 642-8021. I wonder, do you think "smart bomb" capabilities are next?

FIFTY YEARS AGO

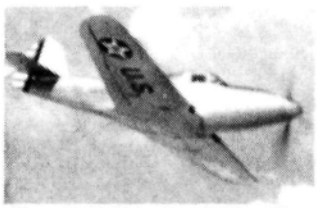
AMERICAN IDEAS AND ENGLISH SKIES

by GERRY YARRISH

THE AMERICAN mind is an inventive mind; the country has benefitted from being the "melting pot" into which talented people from all over the world have been drawn. The July '41 issue of *MAN* amply conveys how American ideas were used to prove the practicality of many designs.

The world's first ever dive-bomber—a plane that dives straight down, pointing its nose to aim its bombs with deadly accuracy—was the Curtiss O2C-1 "Helldiver." In this issue of *MAN,* it was referred to as "the dive-bomber deluxe," and it was shown on the cover.

The big, 30-foot, 4-inch, Helldiver had a 38-foot, 7-inch wingspan and an empty weight of 6,660 pounds. A 1,700hp, 18-cylinder Wright Double Cyclone engine gave it a top speed of 358mph and a service ceiling of 24,400 feet. Its belly housed a bomb bay that could accommodate eight pairs of 150-pounders mounted horizontally. These bombs were ejected by a top-secret spring-loaded device that enabled them to clear the fuselage without detonating in midair. This two-seater, all-metal monoplane proved to the world the viability of the American dive-bomber. (Copied by many; improved on by few.)



Many Bell Airacobra P-39s—then the fastest U.S. pursuit planes—went to England. They carried four wing-mounted machine guns and two in the nose. A 37mm cannon fired through the propeller hub.

AMERICAN WINGS

In increasing numbers, Great Britain continues to buy U.S. combat aircraft for its fight against Hitler's Germany. Bombers, fighters, trainers and transports all find their way into the skies over Europe, but experience brutally shows the Brits that the American aircraft need modifications to survive the war.

A *must have* list evolves, and acceptance of the aircraft relies on the inclusion of: no less than six machine guns in fighter aircraft (eight are preferred); machine guns of at least .50 caliber in bombers (in the nose and tail); at least one full hour's worth of ammunition for each gunner (1,000 rounds); and armor plate (to protect pilots and gunners). This list grows to include self-sealing fuel tanks, self-sealing oil tanks, bullet-proof glass, "recognition" lights, improved seat harnesses and special camouflage. Valuable lessons had been learned, and the need for these "extras" wasn't questioned.

NEWS FLASH

As the need for military aircraft increases and the pool of pilots increases, so, too, does the need for high-school graduates and journeymen mechanics to maintain the aircraft. Wanted: 110,000 men!

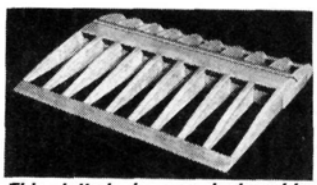
President Roosevelt asks Congress for an additional $289,065,000 for the growing Army Air Corps, starting in July '41. The feeling that war is inevitable looms over the House and the appropriations are granted. It's only a little of what will soon be spent during by the U.S during its involvement in WW II.

Brigadier General Hap Arnold and Rear Admiral R.L. Ghomley set off for England—official U.S. observers of the European conflict. Their jobs?—to increase cooperation between the U.S. and Britain.

As the U.S. aero industry gives birth to faster and more deadly design platforms, the latest aircraft to roll out of the hangar is the XP-51, which is soon to be called "the Mustang." Like all the other fighters heading for England, this one will include all the modifications required to meet the standards that the Air Ministry has set. What a wonderful aircraft the Mustang turned out to be!

SLOTTED WINGS

Though you might think high-tech wings with slots and articulated stall restrictions are contemporary, a detailed, informative article about them appeared in the July, '41 issue. Frank Ehling—then a regular contributor —wrote on the theory, design and construction of slotted wings for modeling. The article included detailed photos of a built-up wing panel that looks more like something from 1991 than anything else in that issue. A typical D-tube construction was used, and the airfoil's forward third was a separate structure. When the two parts of the wing were connected, the joint was a very precise, curved, surface slot. The wing was attached to a test model, and test glides proved that the slot contributed greatly to the model's stability. Even in a seriously tail-heavy condition, the wing refused to stall. When the slot was covered with tape, it was almost impossible to make the model glide because of the rearward location of the center of gravity.



This slotted wing was designed by MAN Editor Charles H. Grant and dramatically improved the stall characteristics of the test model.

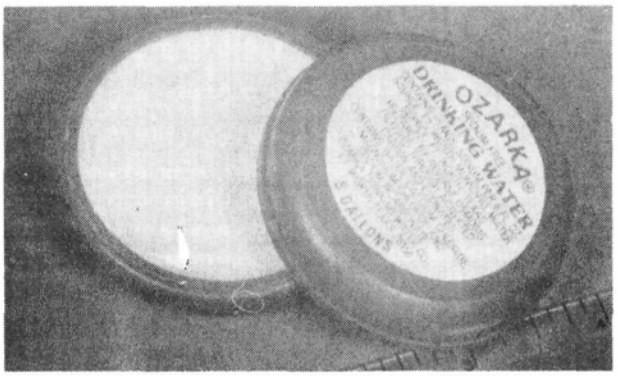
Considering the building materials and composites we have today, there's no telling what we'll come up with in the future. ■

HOW TO:

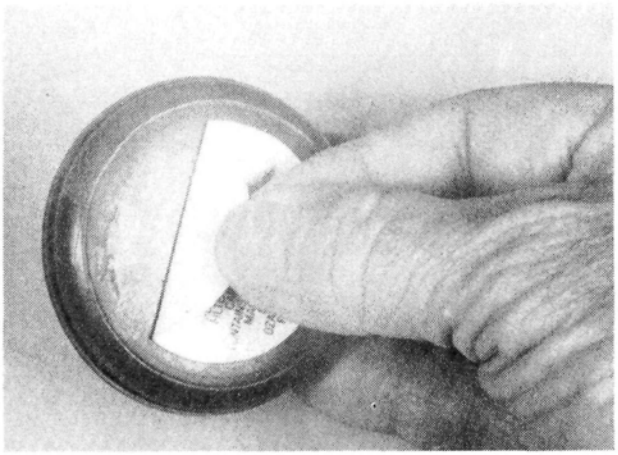
by RANDY RANDOLPH

MORE ON LIGHT WHEELS

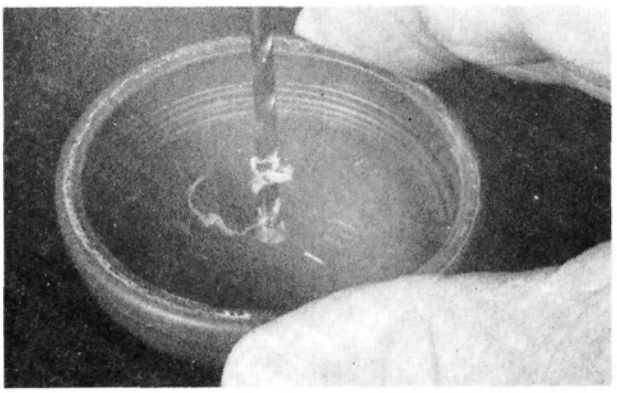
On the average R/C plane, landing gear and wheels are areas where weight can be saved. True, you can now buy light wheels, but even lighter ones are available for practically no cost. The photos show still one more way to make light, durable wheels. (This suggestion comes from reader Wes Moore.)



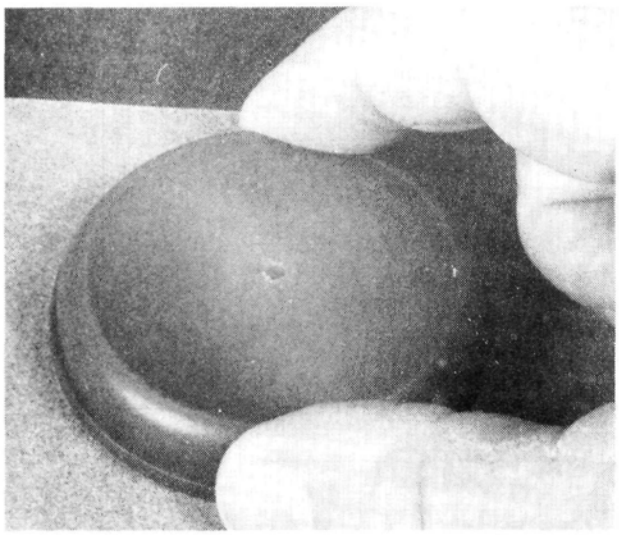
1. The plastic caps that come on 5-gallon jugs of bottled water are almost always thrown away. Four of these caps make a pair of very good 2-inch wheels.



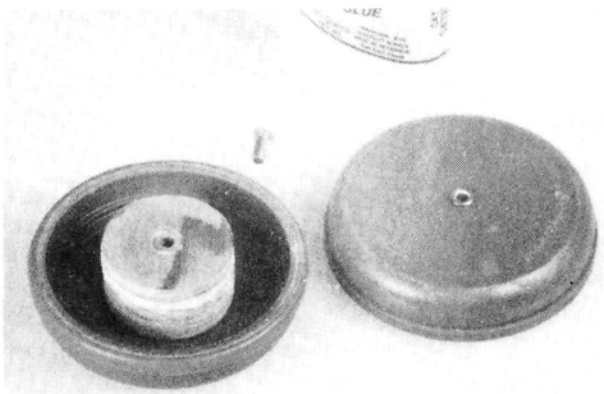
2. Peel the label off each cap. Remove any glue residue with paint thinner; then cover the wheel hubs with Coverite Presto.



3. A bump on the bottom of each cap marks its center. With a center punch, make a hole in the middle of the bump to guide the drill bit, then drill each cap with a 5/32-inch bit.



4. Sand the edges of the caps by rubbing them over medium sandpaper. The sanding roughens the plastic so that it bonds well with the glue.



5. Use a 1-inch hole saw to cut a wooden core. Insert a 1/4-inch dowel into the hole in the core. Drill a 5/32-inch hole in the center of this dowel. Apply glue to 1/8-inch-i.d. brass grommets, and insert one into the hole in each wheel half. Apply glue to the core and to the rims, and press the wheel halves together. (Make sure the grommets are positioned correctly so that they fit into the holes in the dowels.)

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING!

SEND IN YOUR SNAPSHOTS!

MAN is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1991. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in !

Send those pictures to:
Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

MENACING MESSERSCHMITT

Here's an Me-262, the handiwork of John Murphy of Buffalo Grove, IL. This twin-engine WW II jet, built from an Air Flair kit, is powered by two O.S. 91s coupled to two Dynamax fan units. This model, with its wingspan of 84 inches, weighs 22 pounds. The wing, tail, engine nacelles and fuselage are made of fiberglass. John painted his model to match the 262 displayed at the Smithsonian Institute in Washington, D.C. John also installed a gyro to control the rudder.

MULTIPLE MiGS

Alec Cornish-Trestrail of Cheltenham, Gloucester, England, scratch-built these two 1/12-scale MiG 29s using his own designs and molds. The models, which are 54 inches long and have 42-inch wingspans, are made of fiberglass, foam and wood. Power for each 7 1/4 pound model comes from two O.S. 25 VR DF engines with MAC 1822 tuned pipes. Their fan units are Kress RK-720s. Alec tells us these models have been timed at 96mph. The MiG 29UB (twin cockpit) in the foreground also has full flying tail surfaces.

KIT-BASHED KAOS

Carl Purkey of Torrance, CA, tells us he's willing to try anything once—so here's his twin-tail, twin-engine version of a super Kaos. The model has retractable landing gear and is powered by two Enya sport 40s. Carl says he "has a thing for B-25s" (thus the tail configuration) and is very pleased with the slow-speed flight performance of the model. Carl also tells us that when it flies (at close to 150mph!), his friends say his Kaos looks like a Messy Schmitt and they send up their P-51s!

YESTER-YAK

Inspired by the model on the cover of the July 1968 issue of *MAN*, Gary Frank of Phoenix, AZ, hunted for years for the old Sig Yak-18P kit. Built from one of the three original kits he was able to find, this beauty is covered with Super Coverite and finished with K&B Superpoxy epoxy paint and PPG Delclear. Power for this model comes from an Enya .80, which should fly this Yesteryear Fighter with authority.

SPLENDID SPACEWALKER

Rich Van Patten of El Toro, CA, began building giant-scale models in 1984. This beautiful Sig Spacewalker is one of 19 he has completed. It's covered with MonoKote, and Black Baron paint was used on the cowl and wheel pants. With its Super Tigre 3000 engine and its Futaba 6-channel radio, this plane is a pleasure to fly.

NOT A ROUND-TUIT

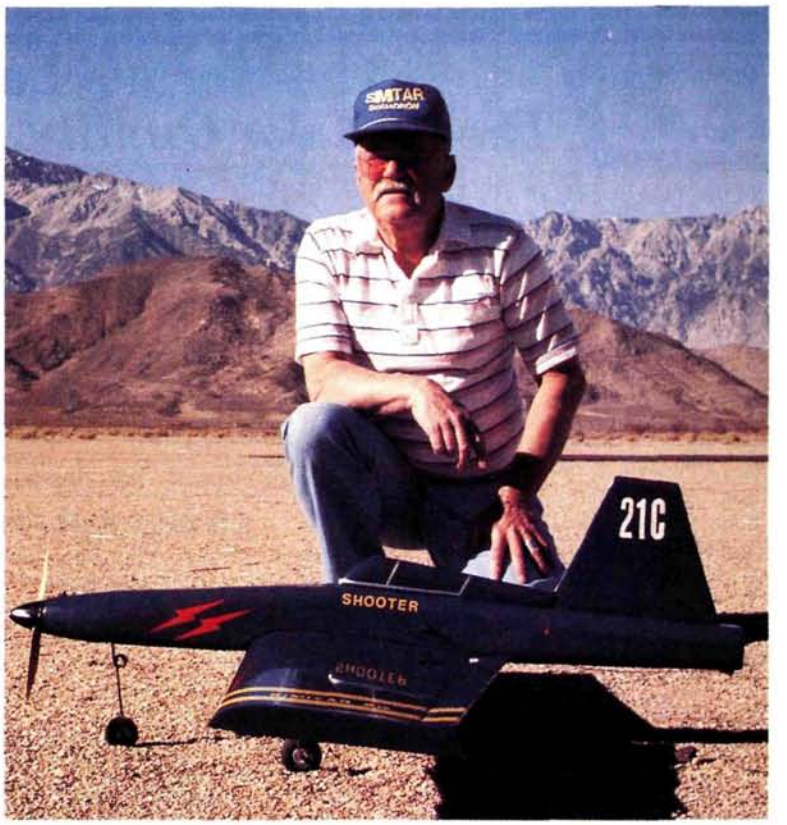
It's a Bradley 40, and it was scratch-built by Brad Greenwood of Atchison, KS. It's made of white construction-grade insulation foam, plywood, balsa and epoxy, and it's one strong bird! Spanning 32 inches, this 5-pound plane is fun to fly. An Airtronics Vanguard radio controls the homemade elevon mixer, and a Fox .40 provides the oomph! for aerobatics. The model is covered with black and yellow MonoKote for high visibility.

CZECH IT OUT!

Through an American pen pal, Jan Vycichl of Plzen, Czechoslovakia, has been receiving *MAN* since 1980. Jan, whose current interests are F3A and scale plans, built this Extra 230 of foam, plywood and balsa. The wings are of balsa-sheeted foam, as are the upper front and rear turtle decks. Its wingspan is 83 inches, it weighs 16.6 pounds, and it's powered by a G-38 Zenoah. Each aileron has its own servo, and the receiver uses a 1.2Ah battery pack. The model is covered with Japanese tissue and is painted with Czech Epolex Colour paint. With the G-38, the model flies very well and is fully aerobatic.

THERE ARE THREE aircraft in the Simitar Series Cowboy group: the Top Gun was first; the Desperado, second; and now there's the Shooter.

I began the design work several years ago, knowing that, to suit a name like "Shooter," the plane *had* to look fast. On the prototype, I slimmed down the fuselage so much that I could only just get a K&B* 6.5 into the nose (using a 2-inch spinner).



by BILL EVANS

SIMITAR-SERIES BASICS

When you've prepared the parts, the Shooter's fuselage construction will only take about 30 minutes, and this is typical of the entire Simitar Series. Its box construction with triangle stock in the corners makes rounding easy and gives it a sleek look.

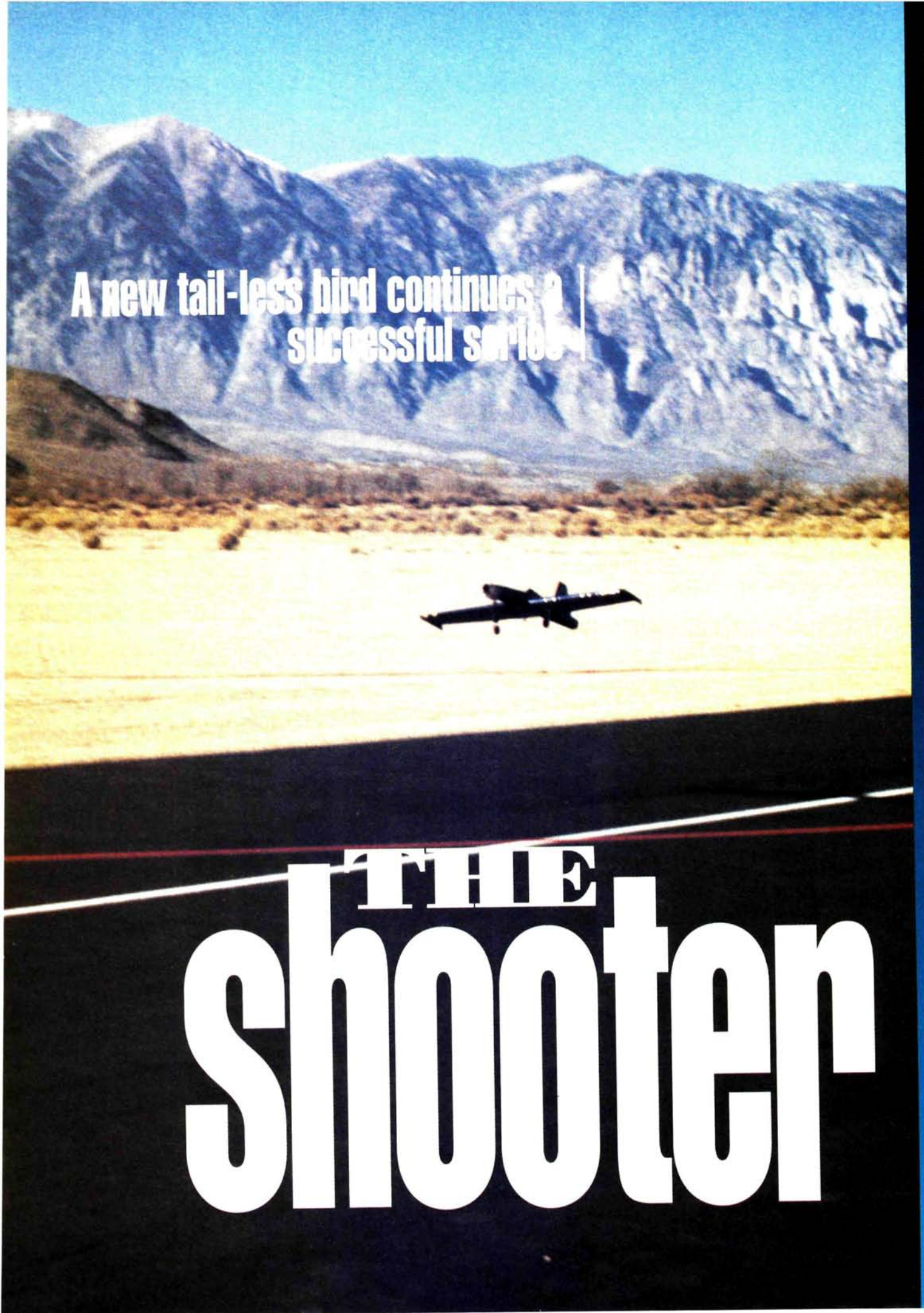
The Shooter's wing is a Simitar-540 foam-core, but its leading edge has been tapered 1 inch. It takes about an hour to sheet the foam-core, whether you use 1/16-inch balsa or 1/64-inch-inch ply.

Though the Shooter looks fast and is fast, with its wide speed range, it can be slowed to glider flying speed without tip-stalling! This is typical of all the planes in the Simitar Series. Does this sound too good to be true? Everyone who sees the Simitars fly is amazed, and some don't even believe their eyes.

Gordy Stahl, of Milwaukee, WI, has had some first-hand experience with the Simitar Series. Several years ago, Gordy flew U-control with his father, and then he became interested in R/C flying. He bought and

SPECIFICATIONS

Type: *Sport (tail-less)*
Wingspan: *50 inches*
Length: *38 inches*
Weight: *4.5 to 4.75 pounds*
Wing Area: *574 square inches*
Wing Loading: *18.6 ounces per square foot*
Power Req'd: *.40 glow engine*
Prop Recommended: *9x6 or 9x7*
No. of Channels Req'd: *4 (nose wheel, throttle, elevator and aileron—elevons)*



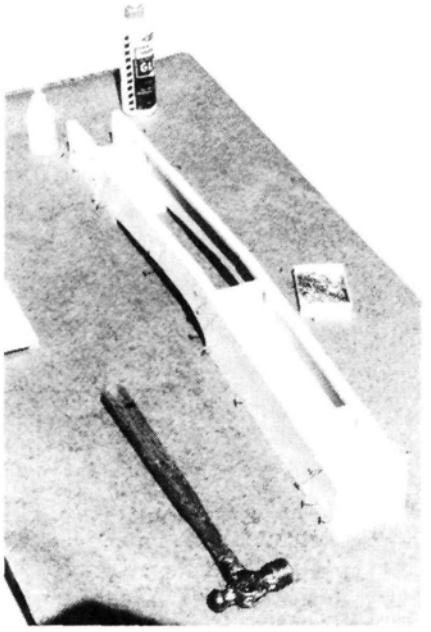
A new tail-less bird continues a successful series

THE shooter

shooter

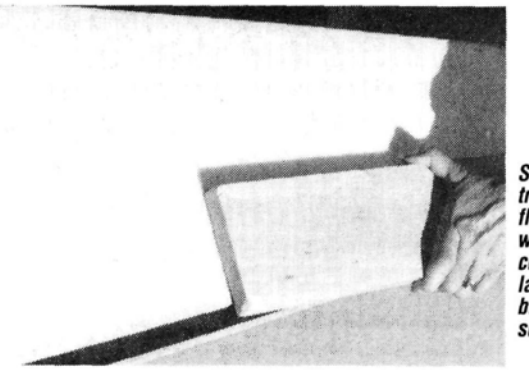
built a typical high-wing, rudder/elevator ship. Unfortunately, his helper crashed it before Gordy got his hands on the sticks! It was recommended that he replace or rebuild the plane. (*Editor's note:* Advice offered by his "helper," no doubt!) Gordy decided to do some research before he started anything and, in the process, he came across some articles I had written about the Simitar Series.

Gordy called me and explained that he had spoken to some modelers who said they were familiar with Simitars. They felt that they were unstable, too quick, or too difficult to fly. I suggested that he contact these people again and ask them how many Simitars they had actually flown. He discovered that they had never flown or even *seen* one flying!

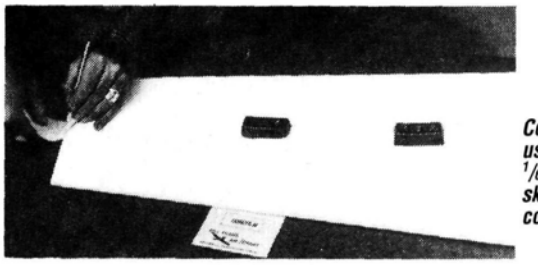


Fuse sides with firewall and bulkheads in place.

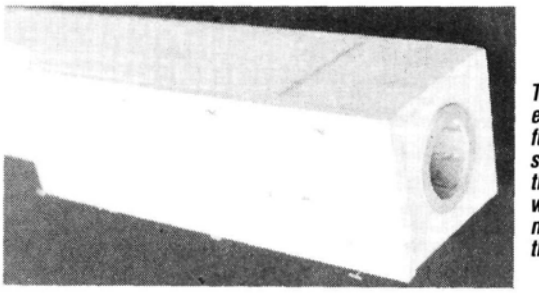
Gordy went on to build and fly a Simitar (without a helper, this time!), and he's now president of the Milwaukee Simitar Squadron. If you want the truth, ask someone who owns one or has, at least, seen one fly. (Gordy, Mike Tyler and Bill Winter are among the many who have hands-on experience.)



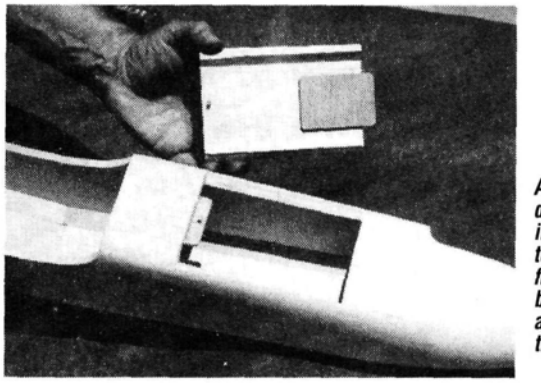
Sand the balsa trailing edge flush with the wing foam-core. Use a large sanding block to ensure accuracy.



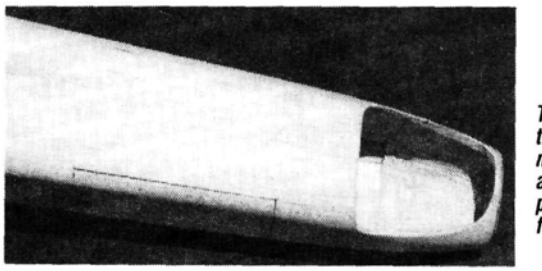
Corefilm is used to bond 1/64-inch-ply skins to foam-core.



The forward end of the fuselage before shaping. Note the ply ring whose size matches that of the spinner.



A lower hatch detail. It's held in place by a tongue at the front edge, and by a blind nut and a screw at the rear.

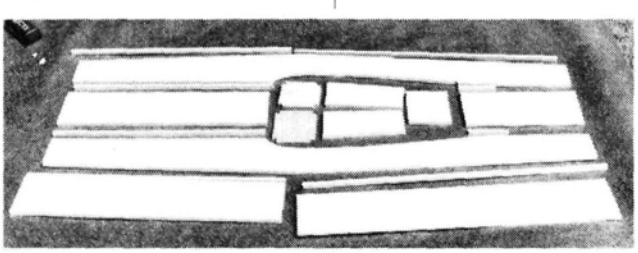


The nose section has been nicely rounded, and there's plenty of room for the engine.

CONTROL-SURFACE FUNCTIONS AND INSTALLATION

For those new to the idea behind the Simitar Series, an explanation of their control-surface functions will be helpful. For perfect flight, the Simitars need only pitch (elevator) and roll control (aileron). Rudder isn't required, although some variations of the Simitar will fly easily on rudder and elevator.

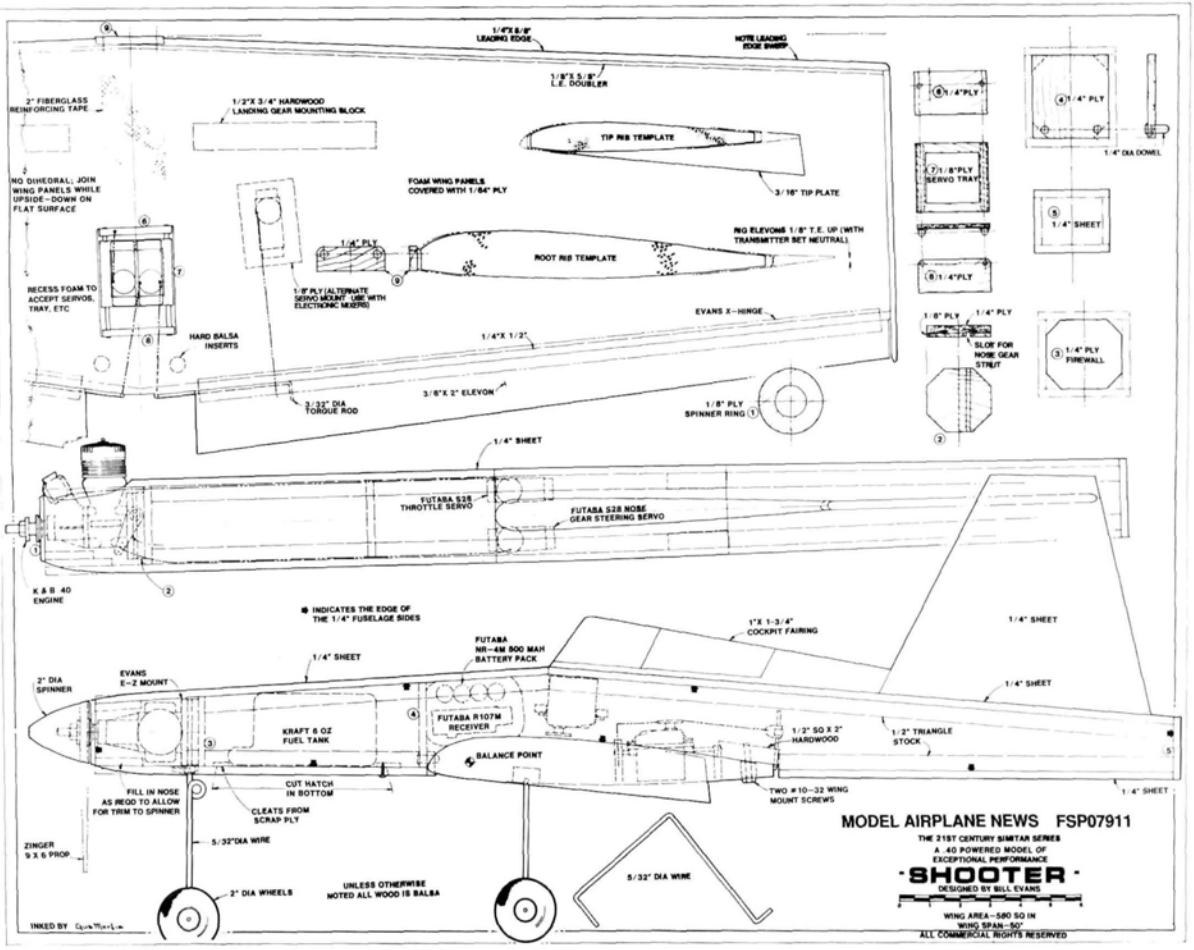
The Shooter's control surfaces use elevons that serve as ailerons and elevators. In essence, the control surfaces can be considered as full strip ailerons that counter-actuate to provide aileron control (roll) and also move in unison to provide elevator control (pitch). "How can that be?", you ask. Some form of control-input mixing is required, and this can be accomplished either mechanically or electronically.



All the required fuselage parts, cut out and ready to assemble.

• **Mechanical mixing.** I've found that the best mechanical method is a sliding tray in

ORDER THE FULL-SIZE PLAN... PAGE 126



shooter

FSP07911 THE SHOOTER $9

Bill Evans has done it again with another great Simitar Series flying-wing design. The Shooter can be flown fast, or slowed to glider-flying speed without tip-stalling. This tail-less design uses "elevon" control for both elevator and aileron inputs, which can be achieved either with a mechanical sliding tray (shown on plans) or with computer mixing. You have to fly it to believe its handling. Construction is straightforward and quick. One full-size plan sheet. WS: 50"; L: 38"; Power: .40, 2-stroke; 4 channels; LD: 1.

which the aileron and elevator servos are mounted. The aileron servo is set up just like strip ailerons, and the elevator servo has its arm attached to a rigid point forward in the fuselage. This allows the tray to slide fore and aft. The aileron servo (obviously, it moves fore and aft, too) moves the elevons up and down to provide roll control.

• **Electronic mixing** makes it possible to mount the two individual elevon servos within the lower surface of each wing panel (see photos). This method dispenses with the sliding tray and provides a more rigid actuator-rod setup.

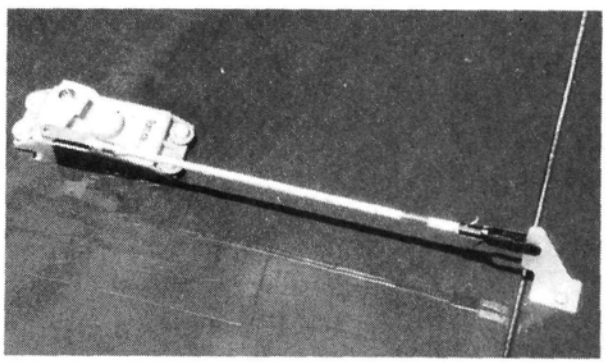
Some radios now have electronic elevon mixing directly through the transmitter. I've used Futaba*, JR* and Airtronics* systems, and they're excellent. It's also possible to accomplish electronic mixing at the receiver by using the Ace* Christy Mixer that's plugged in between the receiver and the servos. This system also works very well.

During the past two decades, I've used all the mixing methods described here in more than 150 Simitar-type ships, and I've had excellent results.

SHOOTER CONSTRUCTION

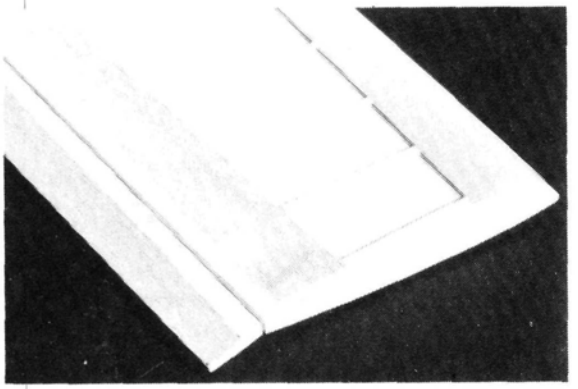
Now, are you ready for a change from the established 50-year-old designs? Let the construction begin!

Build the Shooter according to the plan. If you have a modification in mind, make it after you've flown it as it was



Using electronic (rather than mechanical) mixing allows the use of individual elevon drive servos; one in each wing. Mechanical mixing is discussed in the text.

designed. Construction is easy and quick. The ply-sheeted wing cores are very strong—much like case-hardened steel—and they're available from Soaring Research* (foam wing-cores: $14; 1/64-inch ply wing sheeting: $16—plus $7 for shipping) The outside skin makes a hard, protective shield for the inner core, which serves as a protective shock absorber. The fuselage is built on a flat surface, and its box construction with triangle-stock corners produces rounded, streamlined contours.



Here's a detailed shot of the installation of the X-hinge that's used to attach the elevon to the wing.

Glue (CA, epoxy, or aliphatic resin will do nicely) and then pin the 1/8-inch leading edge and 1/4-inch trailing edge to the wing cores. (Test your CA to make sure it isn't the foam-eating variety, and be sure to keep the cores free of curves or bends.) Set this aside until you need it.

FUSELAGE

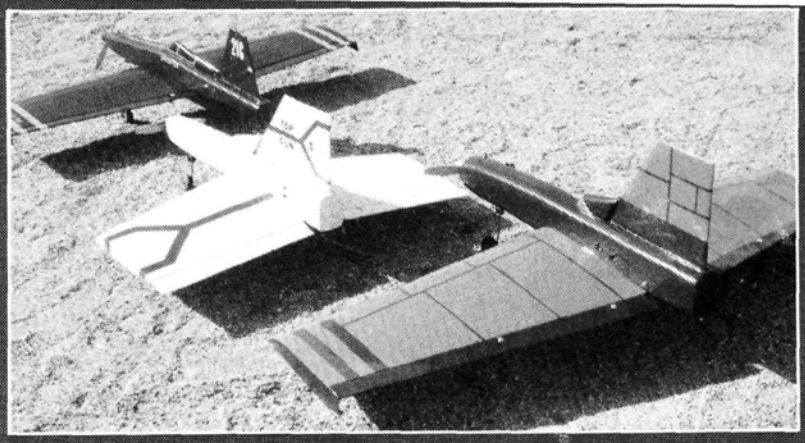
Cut out all the large fuselage parts according to the plan, and pin the fuselage bottom front and rear pieces to a flat surface. Use the sides of the fuselage as guides for setting the front and rear fuselage pieces into position on your building board. Glue and pin the fuselage sides to the bottom pieces; they must rest on top of and be flush with the edge of the bottom pieces. Glue the firewall and the former into place, and position the firewall to suit the length of your engine.

Pin and glue the upper triangle stock, the fuselage top (front and rear) and the rear fuselage cover into place. Glue the inside cowl blocks into position; sand them flush and glue on the spinner ring.

Trim and sand the previously attached wing leading-edge and trailing-edge stock so that the sheeting will fit nicely over the wing core. Cut the ply sheeting to shape (use 1/16-inch medium balsa), making it about 1/2 inch too big in all dimensions.

Clean the cores and the sheeting, then bond the sheeting to the cores. I used Corefilm*, which is a special sheeting transfer tape, but epoxy and 3M spray adhesives work well, too.

(Continued on page 66)

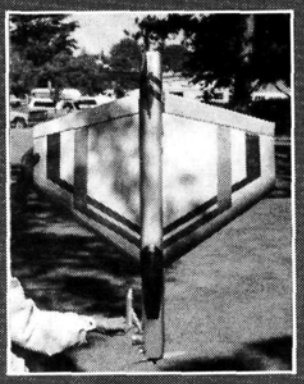


Trio of Similar Series "Cowboys": (from left to right) Shooter, Top Gun and Desperado.

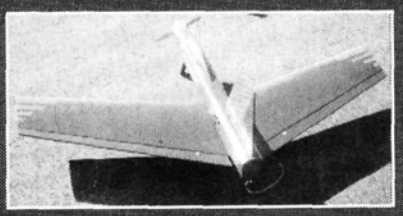
SIMITAR SIBLINGS

by TOM ATWOOD

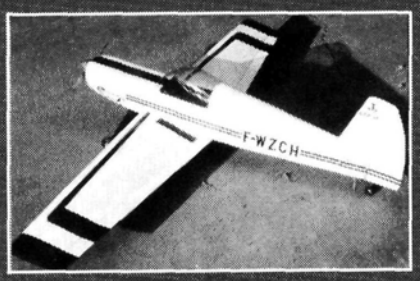
Over the years, Bill Evans has produced numerous successful Simitar designs. Noted for their easy construction and sheer "flyability," this successful breed of flying wing continues to multiply. We've included a few examples here to show the remarkable diversity of style that has been achieved with this planform.



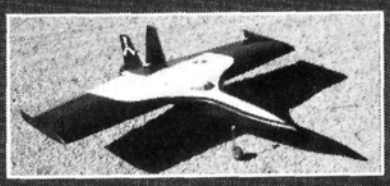
The Pole Star X EPO, which is powered by a 60-size engine, sports a modified delta wing.



This forward-swept-wing "Starshot" was first flown with a K&B 20, but later with 40 power.



Does this look familiar? It's a "T" (tail-less) Cap 21—certain to raise eyebrows on the flight-line.

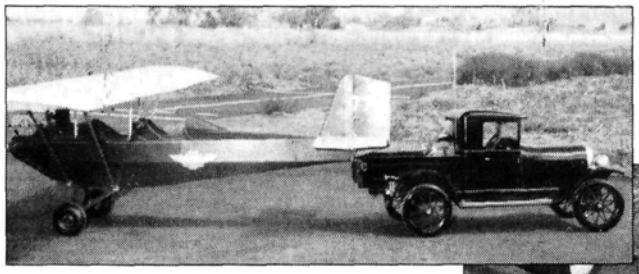


From outer space, the Alien is poised for flight. Won't tip-stall, even in a vacuum.

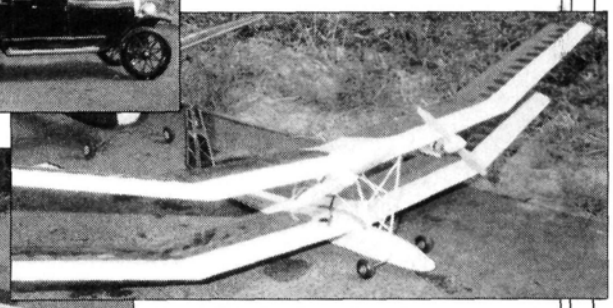
QUIET FLIGHT

ELECTRIC P-51, LETTERS AND EVENTS

by JOHN LUPPERGER



Jim Collins's 1/3-scale Pietenpol with a Model T. It looks about as real as you can get! This beautiful model is powered by an Astro Cobalt 60.



Above: this Gentle Lady makes an unusual biplane. The electric glider, built by Bob Ortman, is powered by two geared Astro FAI 05 Cobalts. Left: Duane Rothacker built this aerobatic, twin Cobalt-05-powered Partenavia.

This month, I'm going to catch up on correspondence from some of my readers and give you information on new products and services from different manufacturers. After a while, the letters get piled so high, I have to sort them out just to get to the computer!

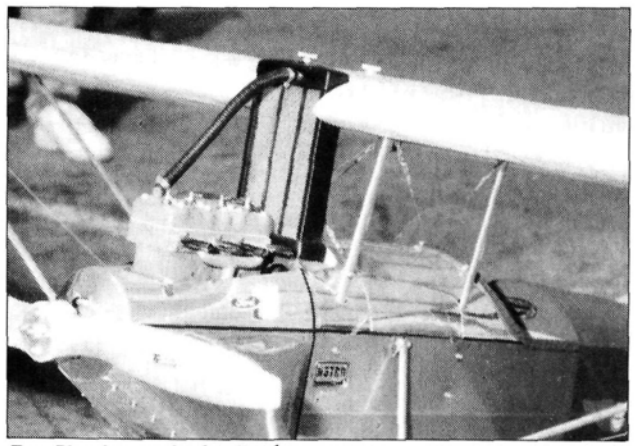
FLIGHT SYSTEM CATALOG

Charlie Sylvia has been running Flight Systems for several years, and his catalogue has really grown. If the product you're looking for is "electric related," chances are that Flight Systems has it, or can get it! Their inventory includes kits, flight systems, motors, props, batteries, controllers, finishing supplies, lightweight accessories and composite building materials. Their prices are low and the selection of products is *large*. As a bonus, the catalogue has some excellent reprints of articles about Ni-Cd care and operation. I don't know if there's a charge for the catalogue, so give Charlie a call at (508) 947-2805, between 6 and 9 EST, and tell him you saw it in *MAN*.

ALL ELECTRIC R/C CARNIVAL FLY-IN

The Santa Clara Model Aircraft Skypark Club held its first annual electric event in June, 1990. Twenty-seven pilots registered 60 aircraft. The variety of aircraft registered showed that people are no longer afraid to try something different with electric power. There were several different awards presented, and an "All-Up, Last-Down" event. Special thanks to Bob Ortman for supplying info and pictures.

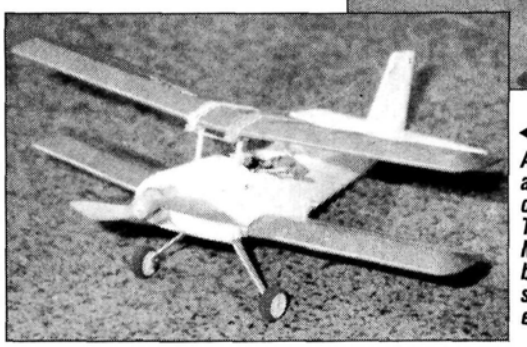
Jim Collins's 1/3-scale, 21-pound Pietenpol Air-Camper won the "Pilot's Choice" award. Powered by an Astro 60 (homemade belt drive) and motivated by 28 1200 mAh Sanyos, the Air-Camper flew very realistically. The award for the most innovative plane went to Bob Ortman for his Gentle Lady biplane. Using two geared Astro FAI 05s on 14 1700 mAh cells, the 5-pound, 14-ounce bipe climbed nearly straight up! Roger Tennyson claimed the "Best Flying Demonstration" award with his Swedish Pilantus. The "Best Finish" award went to Tom Piper for his finely detailed and finished Pietenpol Sky Scout, which was powered by a belt-drive Astro Cobalt 60 on 28 cells. Brian Homsey had the dubious honor of picking up the "Most Spectacular Crash" award. The "Best Multi-Motor" award was claimed by Duane Rothacker for his highly aerobatic Partenavia Victor P-68. This versatile entry was powered by two Astro Cobalt 05s on 14 Sanyo 900 mAh cells. Jeff Ketley's Comet Clipper, with its 120-inch wingspan, was judged "Largest Aircraft." Jeff's model weighed just 8.5 pounds and was powered by a geared Astro Cobalt 40 motivated



Tom Piper's superby detailed 1/3-scale Pietenpol is powered by a belt-drive Astro Cobalt 60 with 28 1200 mAh cells.

by 19 1200 mAh Sanyo cells. I've seen this model fly and the craftsmanship is excellent; it's quite impressive in the air. Terry Fish took the award for the smallest aircraft with his diminutive Micro Aeromaster biplane. It was equipped with a Challenger motor, APC prop and four, 270mAh cells. For its size, the 9.75-ounce bipe with its 16-inch wingspan was very stable. The "All-Up, Last-Down" event was won by Steve Roselle. Steve's winning Berkley Brigadier had a 54-inch wingspan and was powered by a Kyosho motor. This year's event will be held on June 15 and 16. For more information, contact Bob Ortman, 631 Sobrato Way, Campbell, CA 95008.

This 120-inch-span Comet Clipper, built by Jeff Kelety is powered by a geared Astro Cobalt 40. This huge model only weighs 8½ pounds!



At 9.75 ounces, and with a span of 16 inches, Terry Fish's Micro Aeromaster bipe might be the smallest R/C electric around.

Jeff Kelety can also build 'em small. This BD-8 weighs in at 29 ounces with an Astro Cobalt 05 and six 9 mAh cells. Its wingspan is only 29 inches.

ELECTRIFIED P-51 MUSTANG

Bob Rainey of Newport News, VA, sent in some photos and information on a "wet-power-to-quiet-power" conversion that he performed on a House of Balsa P-51. Bob's letter will give you an idea of the mods he made for a successful conversion.

"Enclosed are photos of my 'nearly-scratch-built' P-51D electric-powered model. I started with a 43-inch span HOB kit designed by Rich Uravitch. I replaced the relatively thick (for an electric) fuselage sides and top with stringers and formers covered with 1/16-inch contest-sheet balsa. The tail surfaces are built up in lieu of sheet, and the wing was lightened by use of lower-density balsa. Also, I added the leading edge 'crank' inboard on the wing.

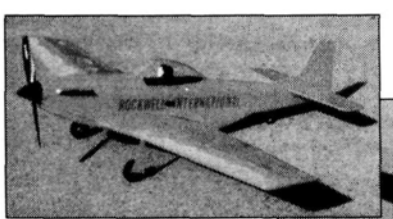
"Inside is a Kyosho 360 PT 2.5:1 geared motor, a 7-cell 1250 mAh Magnum SR battery, and a Futaba Attack 4-channel radio with integral receiver/speed controller. The tail wheel is in the scale location, but not controllable with the rudder; however, the rudder is adequate for ground control. The covering is MonoKote with "Rockwell International" on the sides, à la Bob Hoover's plane. Its flying weight is 42.4 ounces with 340 square inches of wing area, for a loading of 18 ounces to the square foot. As you can see, the wing-loading and weight breakdown are in realistic range.

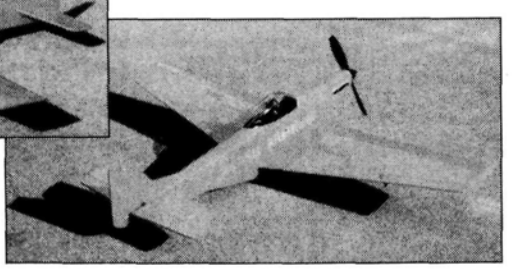
"The only trim adjustment necessary was a bit of down elevator. It handles great, with just the right amount of control authority. I let it run about 35 feet on the asphalt and it lifts off gently. There's no problem in the turns (had a bit of washout in the wings) and on the first flight I came back to about 1/4 throttle on the base leg, turned for final and greased it in onto the short grass after killing the power. Needless to say, I'm elated!

"Looking back on the experience, I see lots of opportunity to use existing plans, altered by free-flight construction techniques, to build many and various scale models for electric power.

"Well, I just had to share the first flight with all who might be interested. Woody Blanchard, my modeling friend of many years and chairman of the Electric Contest Board (AMA), gave me many helpful hints before and during the flight, and I appreciated it. 'Now to recharge!' "

Thanks for sharing your experience with us, Bob. If you've converted a "wet" power model to electric, drop me a line with a couple of good pictures (preferably black and white) and we'll share it with everyone.





Bob Rainey's 42.4-ounce P-51 started out as House of Balsa P-51. After extensive modifications, Bob was able to electrify the 43-inch-span model.

1991 F3B FLYING TEAM

I received a letter from Don Edberg, 1991 chairman of F3B Team Fund Raising. The team needs your support, and it's worth your while to give it. Read Don's letter, and you'll see why!

"I'm writing to you on behalf of the 1991 United States F3B Sailing Team.

(Continued on page 46)

FASTEST R/C MODELS RACE FOR THE TITLE

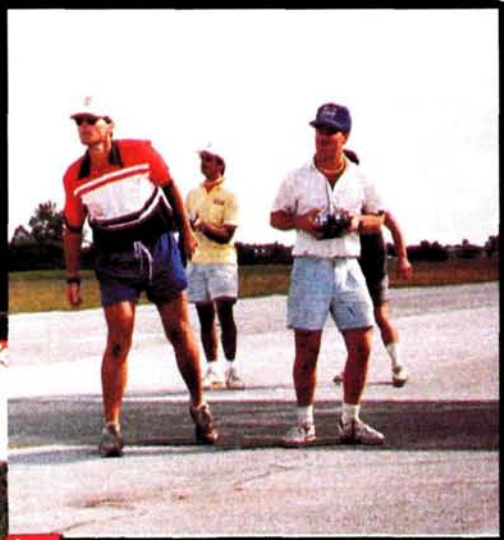
NMPRA Formula 1 CHAMPIONSHIPS

by PAUL STENBERG

■ *Above: And they're off! A good push gets the planes airborne faster.*

■ *Above right: before each heat, the planes are identified. Either that, or it was another exercise period—this time, doing airplane lifts: ready?—now up, down, up...!*

IN ADDITION TO Canada geese, mallards, coots and assorted other feathered creatures, people with big boxes full of model aircraft that fly at more than 200mph get the urge every October to travel south. Last year, our destination was Deland, FL, home of the Remote Control Association of Central Florida. They have a great place to fly airplanes: 200x2,500 feet of pavement (I've seen smaller air fields here in California)! Travel was courtesy of Delta Airlines, and after one maintenance stop (probably arranged by Paul Benezra), we arrived in Florida.



Above: the action on the ground is just as intense as it is in the air. Brian Richmond and Norm Johnson concentrate on flying while their callers, Dub Jett and Lyle Larson, provide information on the course and their planes' positions.

TOP 10 OUT OF 39

Place	Pilot	Score	Best Time
1	Gary Hover	40	1:07.42
2	Dave Shade	40	1:11.84
3	Brian Richmond	39	1:08.57
4	Norm Johnson	39	1:11.89
5	Pete Bergstrom	36	1:13.72
6	Lyle Larson	35	1:12.03
7	Dave Layman	35	1:10.04
8	Don McStay	34	1:13.96
9	Bill Hager	31	1:13.78
10	Paul Benezra	31	1:13.28

Below: the winners with their aircraft. If you aren't in the picture, keep at it and maybe next time...

Above: Mike Helsel won Best of Show with a "Little Toni" painted in the original color scheme. Good job, Mike!

PREP THOSE PROPS

Friday dawned, and everyone headed to the field for test-flying. From 8:30 a.m. to 5 p.m., we all searched for the correct combination of prop, fuel and luck to keep our engines going in the warm, humid air.

Having completed our test flying, it was back to the motel to rub, polish and shine those finely tuned racing machines to enter in the annual beauty pageant called "Scale"—oops!—"Static Judging." Well, all except Gary Hover, who decided that a removable canopy wasn't the way to go and headed for Bob Violett's house to repair and repaint before the usual rubbing, polishing, etc. An open bar seemed to help pass the time, and after the judges had completed *their* task, our President, Mike Helsel, was given the ill-fated honor (more later) of having the Best of Show airplane. Good job, Mike!

IT RAINED PLANES!

Saturday morning came early—especially for us Californians! Someone said that you could test fly by about 6:30 a.m., so we were at the field at 6 a.m. Guess what? It doesn't get light until 7:15 a.m. in October in Central Florida! When the light eventually came, we completed our final test flights.

Dave Tyson called the pilots together for a final briefing and collected his highly professional race crew, and the first round started at 9:15 a.m. Other than Richard Verano (of Futaba fame) trying some aerobatic snap-roll maneuvers and then recovering, the first three rounds were uneventful. Then the curse struck; I heard someone say, "Gee, there haven't been any crashes yet." The next thing we knew, planes were falling out of the air like raindrops! Greg Doe, Henry Bartle, Jerry Small, Daryl Cady and, oh yes, our Best of Show airplane, all hit the ground with less than the usual smooth flare before touchdown. Saturday ended after six rounds, and there were lot of tired people.

On Saturday night, we enjoyed the usual banquet, and lots of fun was had by all. The top 19 National Point Winners were awarded engraved watches, and Dave Shadel, who was *the* National Point Winner, was presented with a classy camera to record Sunday's fun.

SUNDAY SMARTS?

We were a little smarter on Sunday, and didn't get to the field when it was still dark. (Who said racers are "untrainable"?) After the test flying, the final rounds of racing began, and it was time for things to get serious—and the winner wasn't yet *close* to being determined.

The weather was uncooperative—lots of thunder and lightning in the area (great place to be during a thunderstorm: standing in the middle of a field with a 50-inch antenna—so much for "trainable" and getting smarter!). Having set the fast time on Saturday of 1:07, Gary Hover managed to set the slow time with a 2:18! Paul Benezra and Dave Doyle had a midair that only Benezra could survive and still place in the top

TWO SIGNIFICANT INNOVATIONS

Jerry Small from Texas brought his new "Kazi Killer" to Florida. This expression is often seen on racers' faces.

We all know that some stuff works and that some are miserable failures. Formula 1 Racing has certainly provided a test bed for many new ideas. Just as high-performance car racing has led to many innovations, so has Formula 1 R/C provided modelers with numerous advances in engine and airframe technology.

This year's race seemed to exhibit more new technology than we've seen in quite some time. We were all striving for that something extra that would give us the advantage we needed to win. Looking back, I think there really wasn't very much difference between the 1st and 10th-place racers; sometimes, success was a matter of luck, while at other times it was the result of a new technical feature.

The two most noticeable changes at this race were the new fuel systems and the high-aspect-ratio wings. The fuel system isn't really new; just new to Formula 1. It involves a bladder-type fuel tank and a pressure regulator that's controlled by engine crankcase pressure. The people using it seem to be happy with its performance; for the most part, it results in more consistent needle-valve settings. Its most significant advantage is that only half as much fuel is needed, and the resulting reduction in takeoff weight gives a speed advantage during the first couple of laps.

The high-aspect-ratio wing is still being evaluated. Gary Hover and Dave Shadel had new wings for the "Kazi," and Jerry Small had one on his "Kazi Killer." (Where else would you find names like that?) The airplanes were fast, but they didn't seem to be faster *because of* the new wing.

The other part of the wing story is the light, exceptionally strong composite wing that Gary Hover has come up with—a composite wing without the traditional foam core. Henry Bartle has gone way into the high-tech world by making a wing out of thermal plastic. Again, it's a hollow wing that's light and almost bulletproof. Imagine; a Formula 1 racer that can be crashed, dusted off and then flown again!

As I said: some stuff *works!*

The Second Great R/C

Design Contest

—Your chance to become a famous modeler!

The best five designs will be featured in Model Airplane News as construction articles, and all will be considered for publication.

1st Place—$1,200	4th Place—$500
2nd Place—$900	5th Place—$250
3rd Place—$750	

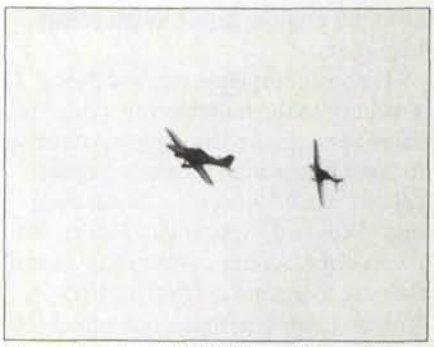
How to enter:
Submit several clear photographs of your model (include flight shots, if possible) by AUGUST 1, 1991. Only models that have never been published or manufactured are eligible, but there is no restriction on type of R/C plane.

Who will choose the winners?
The *MAN* editors—with your input! Later in 1991, we'll publish photographs of the models, and you'll send us a postcard indicating your favorite.

Announcing the winners:
Model Airplane News will feature an article giving details of the five winners, and each one will be the subject of a feature construction article.

Be prepared!
Winners must be prepared to submit a complete construction article (6 to 8 typed, double-spaced pages; formatted on disc is preferred), good black-and-white photographs of the building sequence, full-size construction plans and color slides of the model, both on the ground and airborne. Before announcing the winners, the publisher must receive proof that plans, photographs and articles are available for the five chosen designs.

Formula



Above, two aircraft battle for position as the go around the no. 2 pylon.

10. The high level of competition at the race meant that there were no easy heats, and after 11 rounds of racing, Gary Hover was on top.

RACER'S REMINISCENCE

Looking back, I realize that this was one of the best Championship races I've attended. It's difficult to appreciate how much work goes into preparing for a race, but Dave Tyson and his crew deserve lots of credit for making it great. Eleven rounds with 39 entrants, and there were no "re-flies"! That's a great record. Mike Helsel and the NMPRA staff also did a great job putting the race together.

Special thanks to Futaba's Richard Verano and Steve Helms who donated 10 top-of-the-line radios for prizes. We also owe thanks to Don Dombrowski (House of Balsa) and Hershel Worthy (Pacer) for providing cash prizes and Zap adhesives. They all supported us for the entire year with the "Zap smash stations," so spread the word to your friends. Thanks guys; we couldn't have had such a great year without you.

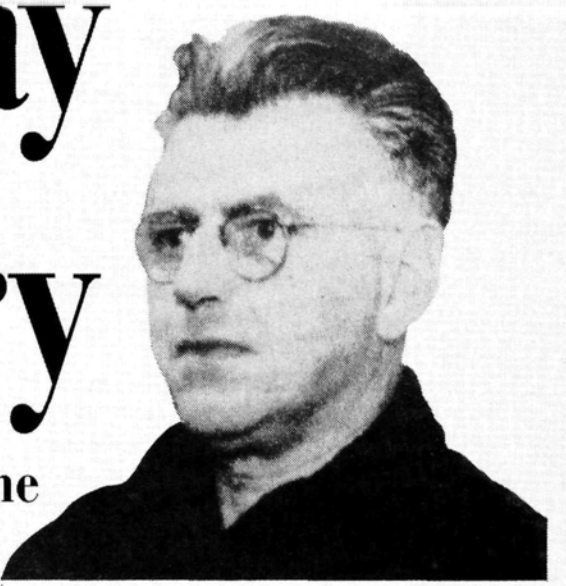
Oh yes, thanks to the racers who came from all corners of North America. Without you, there wouldn't be this great event we call Formula 1. Keep up the wonderful work! Don't let down the standards of the greatest event in modeling, and we'll all get together at the starting line in 1991.

Editor's note: *the National Miniature Pylon Racing Association (NMPRA) welcomes newcomers to the exciting, cutting-edge world of pylon racing. For information, contact Ron Schorr, 5224 Teesdale, North Hollywood, CA 91607; tel: (818) 985-5527.* ■

the Ray Arden Story

Father of the Small Engine

by FRANK GUDAITIS



IN THE ENTIRE history of model aviation, few individuals can honestly be called "revolutionary innovators." Thomas Raymond Arden was unquestionably a member of this elite group.

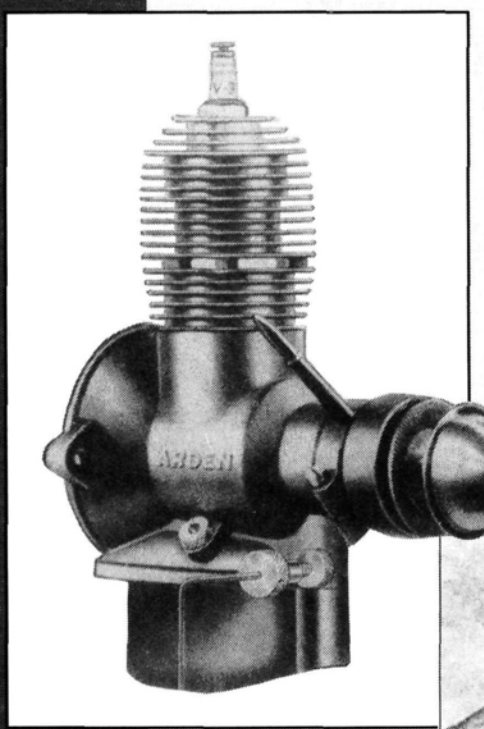
His invention of the interchangeable glow plug forever changed aeromodeling by improving model airplanes equipped with internal-combustion engines. His Atom engine significantly reduced the size of gas models and enabled "kitchen-table" builders to join the ranks of this fascinating hobby.

As small as the Atom engine was—it had a bore and stroke of 1/2 inch—Arden actually succeeded in further shrinking his design by 75 percent. The result was an incredible subminiature gas engine that had a bore and stroke of 1/8 inch! Over a half century later, it remains the world's smallest spark-plug ignition engine.

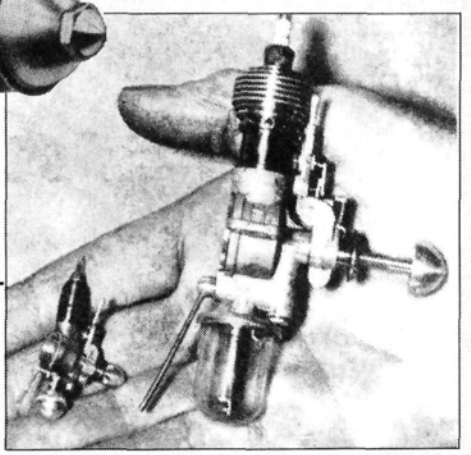
THE PRODIGY PRODUCES

Ray Arden was born in the 1890s. As a child, he displayed a natural affinity for mechanical contrivances. On July 17, 1904 (the year following the Wright Brothers' flight at Kitty Hawk), *The New York Sunday Herald* described how young Arden had successfully constructed a steam-engine "car." It had a 4-foot wheelbase, and it was powered by a 1/2hp engine that he had built.

In 1906, a neighbor took Arden to a sportsmens' show at Madison Square Garden in New York City. There, Ray met Augustus Herring, one of the early pioneers of flight. Herring was an engineer who had helped Octave Chanute to develop his early gliders. At the show, Herring displayed a biplane model with a 6-foot wingspan. It was powered by a crude, single-cylinder, miniature gas engine that weighed 2 pounds. This small engine fascinated young Arden; he studied it for hours and questioned Herring endlessly. Arden

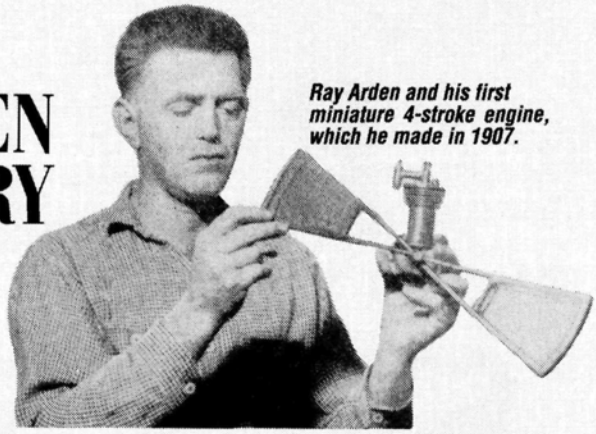


▲ *The Arden engine (manufactured by the Bard Parker Co., of Danbury, CT), was available in two sizes—.099 and .199. The only difference between the two was piston displacement.*



◀ **The mass-produced Atom engine shown next to Ray Arden's smallest gas engine.**

the RAY ARDEN STORY



Ray Arden and his first miniature 4-stroke engine, which he made in 1907.

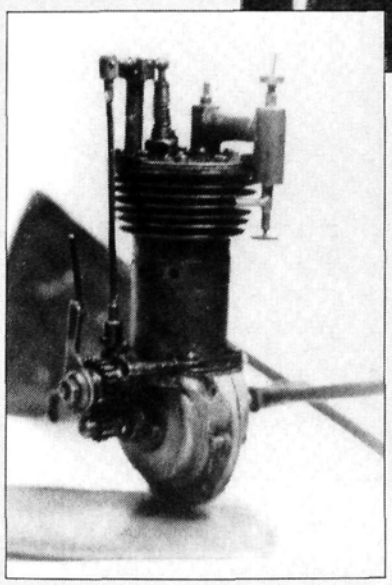
▲ *The world's smallest ignition engine. Its piston's diameter was 1/8 inch (circa 1938).*

came away determined to build one smaller, lighter and better.

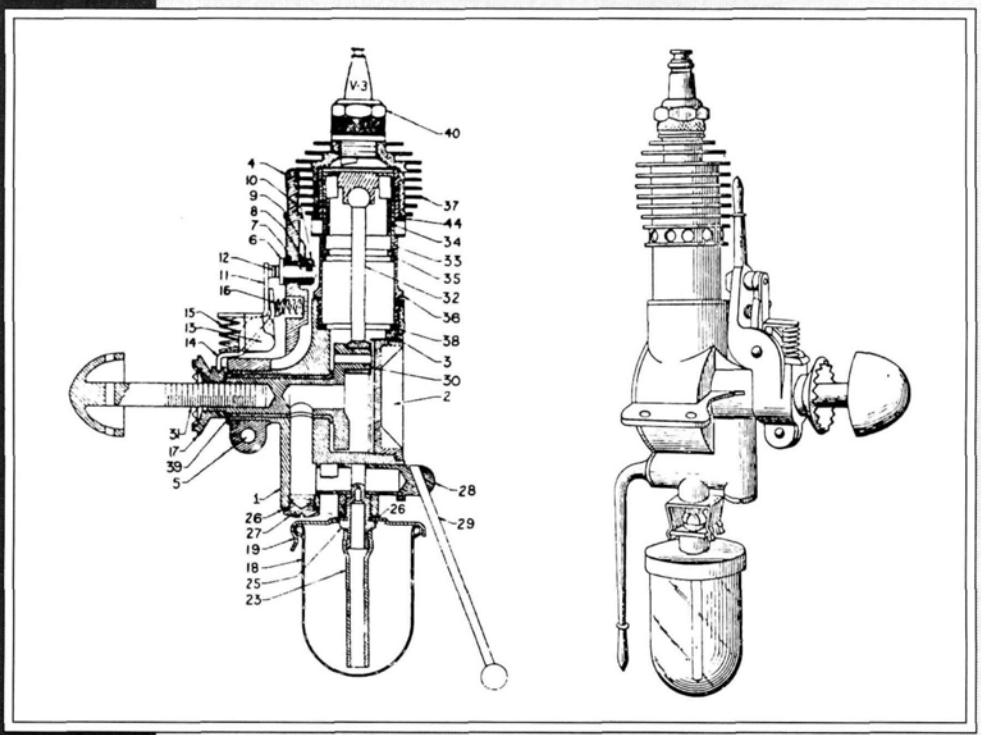
By the end of 1907, he had achieved his goal. The result was a single-cylinder, 4-stroke gas engine with a supplementary glow-element ignition! It was the first of many miniature engines to emerge from his shop. In the years that followed, he patented over 400 of his inventions, which included steam automobiles, x-ray machines, toys, surgical instruments, induction coils and various electronic apparatus.

ARDEN'S ARDOR

His first love, however, was always the tiny gas engine. During the late '30s, he designed and patented the engine that became known as the "Mighty Atom." Its superior features made it unique among engines of its time. It was the first miniature gas engine with 360-degree exhaust porting. Its piston contained a sub-piston that reciprocated vertically and acted as the intake "valve." The fuel-intake porting was below the crankcase, which provided the incoming fuel with a beneficial warming from the residual heat of the crankcase metal. A simple lever that controlled air intake replaced the conventional needle valve. This engine was produced and sold as early as 1939 with features that were far ahead of its time. In the decades that followed, some of these features were adopted by a number of the world's miniature engine manufacturers.



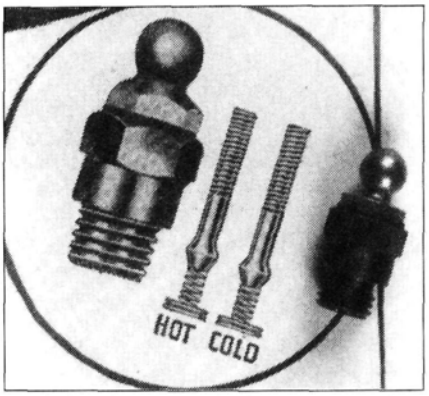
◀ *Arden's first 4-stroke engine made in 1907.*



Patent drawings for T. R. Arden's motor for toy airplanes (the Atom). Filed on May 13, 1939.

THE INTERCHANGEABLE GLOW PLUG

RAY ARDEN WAS responsible for the introduction of the interchangeable glow plug. This development had a profound and long-lasting effect on all miniature models, whether they were aircraft, boats, or race cars. Overnight, gone were the ignition coil and condenser, the on-board batteries, and the timer arm and contact points. The simplicity of the glow plug made the spark-ignition engines almost obsolete.



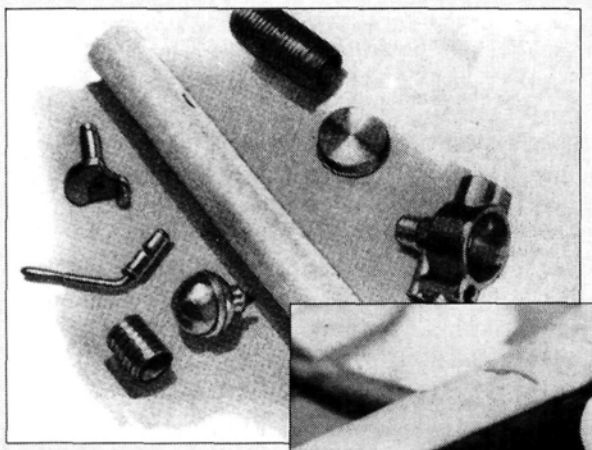
The Arden glow plug with interchangable glow elements.

In 1938, Arden produced what must surely be called his masterwork. Picture a spark-plug ignition engine that's $1\frac{1}{16}$ inches high, weighs $\frac{1}{8}$ ounce and has a spherical gas tank that holds four drops of gasoline mixed with oil. The $\frac{1}{8}$-inch-diameter chrome-molybdenum piston even has a concentric sub-piston for fuel intake! Making the tiny spark plug *alone* required 100 hours of work. The electrodes were made of a platinum-iridium alloy and insulated with quartz. The engine turned a 3-inch-diameter, hand-carved wooden prop at 18,000rpm. The four drops of fuel in the tank were sufficient for a 4-minute run with a total of 72,000 revolutions.

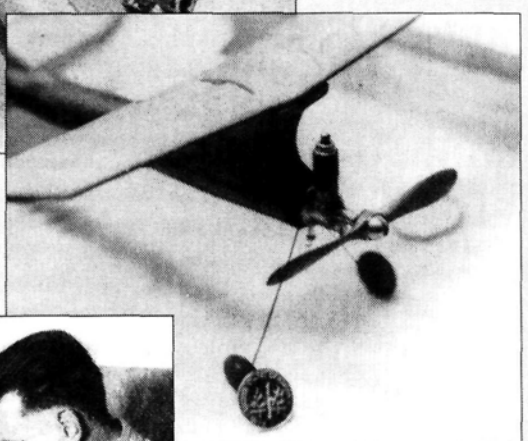
In 1948, I had the privilege of meeting Mr. Arden. After holding one of his tiny engines in my hand, I remember asking him what it would cost to build another (there were then two in existence). He replied that the cost would be astronomical. The hours required to work to incredibly precise tolerances of less than $\frac{1}{10,000}$ inch would almost make it priceless.

One of *Model Airplane News*' former editors, the late Walter Schroder, knew Arden. Schroder was invited to visit Arden's lab and workshop on a number of occasions. He was visibly impressed by what he saw there. I remember that he referred to Mr. Arden as a "real genius."

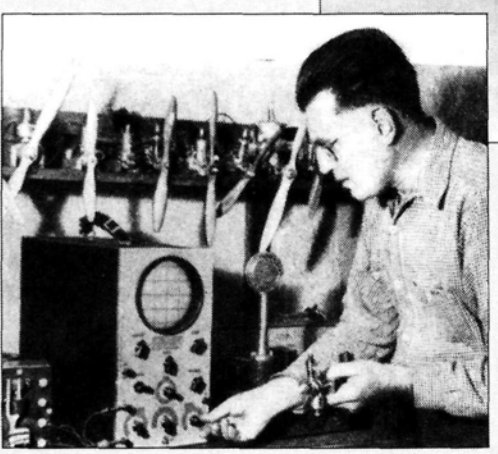
Following the end of WW II, Ray Arden designed the Arden engine. It was manufactured by the Bard Parker Co., a surgical instrument manufacturer in his hometown of Danbury, CT. The Arden .099 and .199 engines were identical except for a difference in piston displacement. They incorporated the original design of the Atom engine with the addition of two precision ball bearings on the crankshaft. The intrinsic high quality of these engines and their outstanding performance quickly won them wide acceptance with the model-building fraternity. Ray Arden's lifetime of achievements should serve as an inspiration to many bright young model builders. If he were still with us, he would probably tell us that even in this day of high technology, it's still possible to be an original thinker with an unlimited imagination. ■



▲ *The components of the world's smallest gas engine next to a regular cigarette.*



▲ *Arden's smallest glow-plug engine in what was probably the world's smallest free-flight model—12-inch wingspan. (Note the dime by the right landing wheel.)*



◀ *Ray Arden tests one of his experimental miniature engines, circa 1948.*

GIANT STEPS

NEW PLANS AND PUYALLUP

by DICK PHILLIPS

This Quadra-powered Waterman Aerobile is by Bruce W. Gale who's a member of MRRCS and the Puget Sound ROC's club. The full-size version of this unusual plane was as an early attempt to build a safe airplane. It was the co-winner of the 1935 Vidal Safety Airplane Competition.

MY PUBLISHING partner, John de Vries, and I have been gathering plans for the fourth of our large plans directories, and we've been receiving new ones in encouraging numbers recently.

"Spectacular" is the word that best describes Nick Ziroli's newest set of plans. They're for the twin-engine Beechcraft D-18 (known to the military as the C-45). Previously, Nick designed plans for the B-25 Mitchell and the DC-3, and the Beech is an excellent choice for his third twin. Like its two predecessors, a few full-size examples of the Beech are still flying. (I flew in a floatplane version a few years ago, and the floats were about the size of Cessna 150 fuselages!)

Spanning 114 inches, the 80-inch-long D-18 model is large even by giant-scale standards. With a wing area of 1,950 square inches, the model comes out somewhere between 38 and 50 pounds, depending on how heavy the builder's hand is. The specified engines range from Quadra 35s, Q40s and 42s to a pair of Zenoah 38s.

If its full-size counterpart is any criterion, the twin Beech model should fly fairly well. Its large wing area (light without sacrificing strength), and its ample control area (the rudders in the prop blast are helpful) are beneficial. If you haven't built twins before, this well-known Beechcraft is an excellent place to start. There's a lot of detailed information available on the civil and military versions.

Nick Ziroli's Ju 87 Stuka plans have been around for a while, and I've seen photos of several models that were built from them. At 18 percent of full size, the 77-inch-long Stuka is a large bird with a 100-inch wingspan. It will handle anything from a 3ci to a 4.2ci engine. Cowling, wheel pants and canopies for the Stuka are also

Dick Hansen built this beautifully detailed Albatros DVA from a Proctor kit. Dick is another member of the Portland Sky Knights.

PHOTOS BY DICK PHILLIPS

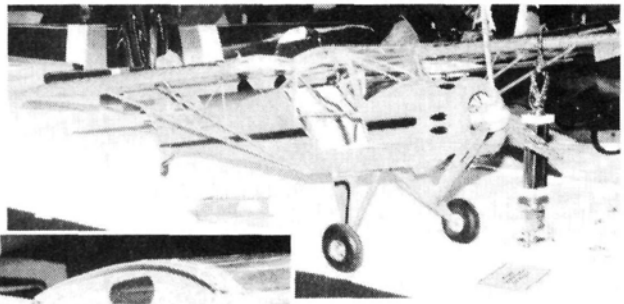
available from Nick as accessories.

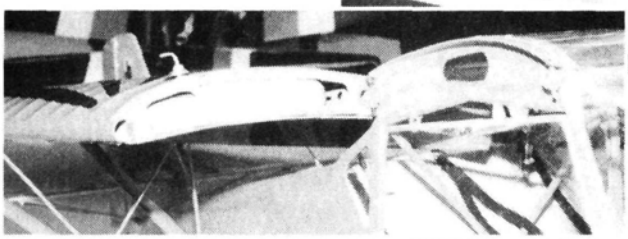
As the Luftwaffe's primary dive bomber, the full-size Stuka needs no introduction to anyone who's familiar with WW II aircraft. The model would make a sharp-looking addition to anyone's collection of WW II iron, and it's one that's not seen at every scale contest or rally in the country. Properly flown, it's spectacular.

All of Nick's plans are of the conventional balsa-and-plywood construction, and they shouldn't be difficult for those with a few kits and a plan or two under their belts. Nick is no stranger to the drafting board or the building board, and it shows in the quality of his work. We hope to see more of his plans in the near future.

Here's Jerry Holcomb's Sikorsky S-39B. Jerry is a member of the Sky Knights in Portland, OR.

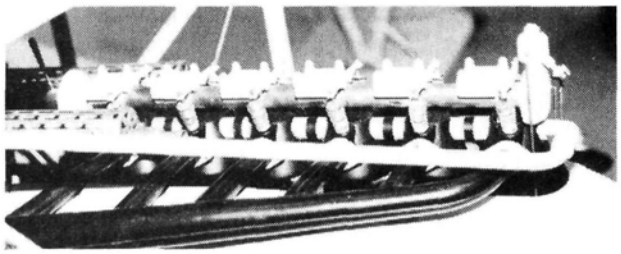
Right: This Kitfox was scratch-built by Sid Tanabe who's a member of the BARKS Club in Boise, ID. Although I neglected to note the category, the trophy indicates that the judges liked Sid's work.





Left: From this photo of the Fox's wing folding, you can see that Sid Tanabe does nice work. The fuel tank in the end of the wing shows the corrugations that are typical of such installations.

Right: The engine details on Dick Hansen's Albatros show that he obviously knows his way around a building board.



NORTHWEST MODEL EXPO

The first weekend in February is an important one for modelers in the Northwest. It's the weekend of the Model Expo in Puyallup, WA. This show is Washington state's equivalent of WRAMS, Toledo and all the other annual modeling shows. Although I haven't attended all of them, I guess that the Puyallup show is about the smallest one.

Hobby shows enable me to meet readers and keep in touch with what modelers are building. It's also a chance to chat with suppliers about what's happening in the hobby and see their new products and plans.

The Northwest is notorious for its wet weather in February. Although the weather for the Model Expo '91 was no exception, there was enough nice weather for most of the outdoor demonstration flights. These included R/C helicopters, electric aircraft and some control-line planes.

The show was held in a new, large, well-lit two-story building at the Puyallup Fairgrounds. The lower floor was reserved for commercial exhibitor booths, and the local modeling clubs had booths on the upper floor. The outdoor demonstrations took place in an adjacent baseball diamond.

The experienced organizers ran a well-managed show that attracted the largest crowds in the event's history. Some of those who attended told me that this year's Expo attracted more people than the IMS show in California (not bad for the relative new kid on the block!).

Proctor* models was there, with its growing (literally and figuratively) line of models. The models are larger, and their quality is as high as ever. The Proctor Albatros DVA is a real beauty and, from the uncovered version that was on display, you could easily see the workmanship that goes into these high-quality kits.

Because I'm a classic '30s airplane fan, Byron Originals'* Ryan STA also caught my eye. It's a beautiful airplane, and owing to Byron's well-engineered kit, it flies as well and looks just as good.

Sig Manufacturing's* Mike Gretz demonstrated the company's new hinges. These easy-to-install plas-

(Continued on page 68)

QUIET FLIGHT

(Continued from page 35)

This year, the U.S. team will be competing for the Dan Pruss Memorial Team Trophy at the F3B World Championships in Holland. Limited funding comes from the Academy of Model Aeronautics to cover air transportation and entry fees, but the remainder of the costs must be covered by donations. These costs include overseas car rental, model airplane box shipping costs, uniforms, on-site shelter, and other related expenses. This year, the F3B Team is holding a raffle for prizes donated by the hobby industry. The winners will be chosen randomly at the 1991 AMA Nationals in Illinois this July. Prizes have been requested from over 150 donors, including virtually the entire hobby spectrum: R/C systems, batteries, accessories, newsletter and magazine subscriptions and other merchandise. We're even giving away a round-trip airline ticket to the 1991 Worlds in Holland as a Grand Prize. In addition, the team is selling merchandise, including hats, T-shirts, pins and patches.

"Show your support, as the 1991 Team of Jolly, Wurts and Perkins may very well be the best we've ever sent to a Worlds. This event may be our year to be World F3B Championships."

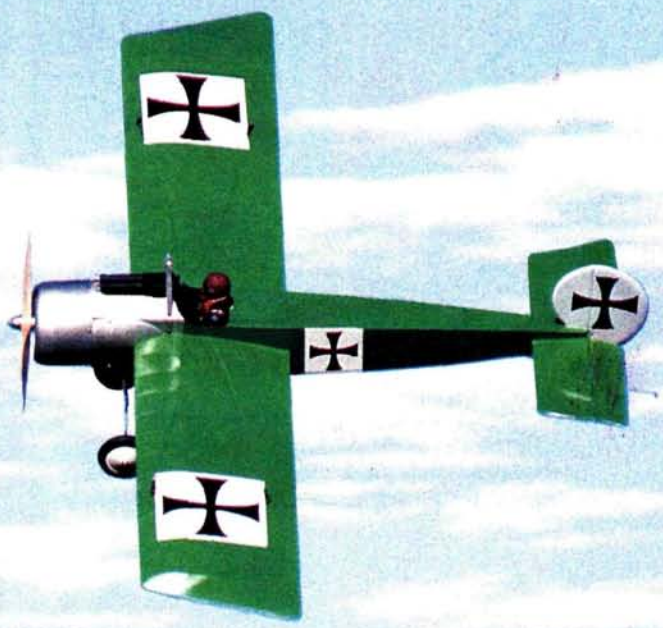
Please send inquiries to: 1991 U.S. F3B Soaring Team, P.O. Box 3242, Lakewood, CA, 90711.

CONTEST ANNOUNCEMENTS

JUNE 2: The Inland Soaring Society's 8th Annual R/C Hand-Launched Glider Contest, in Riverside, CA. The Grandaddy of all HLG events. For more information, call Ian Douglas (714) 621-2522 after 6 p.m. PST.

(Continued on page 66)

electric DAWN *patrol*



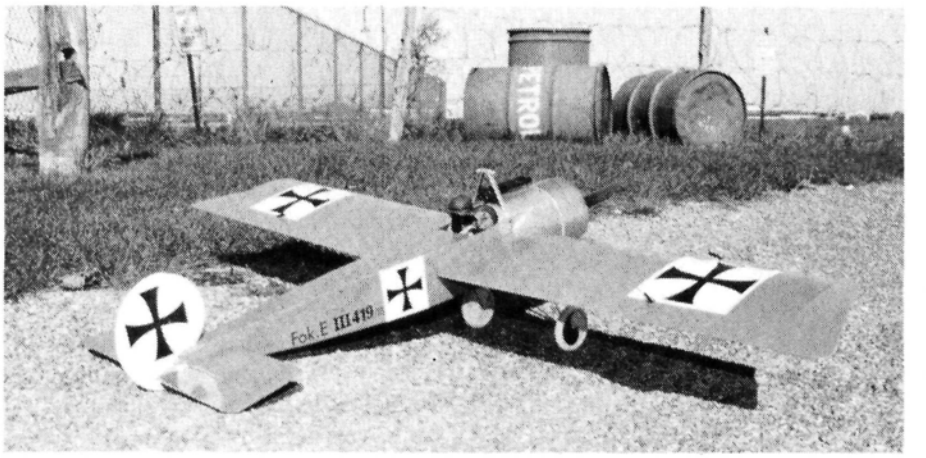
GRAUPNER

eindecker

by CLYDE GEIST

I REMEMBER my first model airplane and how much pleasure I took just watching it in simple flight—no daredevil stunts, mind you; just fun. This electric Eindecker from Graupner brought it all back to me, and it might do the same for you.

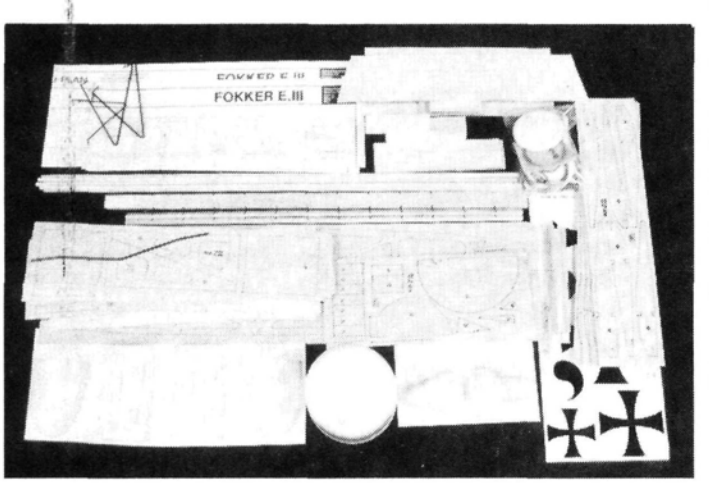
Most of today's electric-powered aircraft are either entry-level motor gliders and trainers or high-performance demons. (Even after 100 flights, my electric racer still rattles my wits every time I fly it.) It was during my quest for an ideal plane to fill this gap that I discovered the Fokker E-III in the Hobby Lobby* catalogue. It was described as a "scale electric" (hmmm) that only needed an inexpensive .05 motor and 3-channel



radio equipment, and it looked easy to build. (Could this be it?) You could easily disassemble it to fit into any car, and it had a wing loading of 20.5 ounces per square foot. It could fly faster than my bent-wing motor glider. I *had* to have this plane...! It really seemed to be a cut above any trainer, but not difficult to fly!

KIT CONTENTS

There's an illustration of a completed E-III model with authentic military markings on the kit's attractive box, and the parts are packed properly to minimize shipping damage. The kit has an abundance of numbered, die-cut balsa and plywood parts, and every detail that's shown on the box is included: formed landing gear with hard plastic wheels, quality hardware, decal sheets and many vacu-formed parts. There are two, large, full-size plan sheets and one photo-illustrated instruction sheet (in German) that's supplemented by a nine-page construction manual (in English).



The kit is complete, and all the parts are of a high quality.

CONSTRUCTION

The manual suggests several Graupner power options. Although the E-III will easily accept dozens of motor/control combinations that aren't listed, you'll find that this kit is just one part of a carefully engineered system. Graupner parts fit precisely and easily, and it's a good idea to order any system components before you start to build, because some of them are used early in the construction process. I chose Graupner's 600BB 7.2V motor and, to control it, the Graupner 20A receiver-activated on/off switch. Larry Sribnick of SR Batteries* suggested that I use 8-cell packs, so I ordered two 1200mAh Max packs. I used 5-minute epoxy wherever the assembly instructions recommended it; otherwise, CA was my choice. Grab your metric ruler, because here we go.

The fuselage is made of die-cut parts, and it's important to check that everything is square as you build. Cut the 6x12mm hardwood landing-gear mounts to 140mm lengths before you glue them to the sides. Drill the wing-mounting-tube holes in the spots that are marked with "dimples." Do the same with bulkheads 7, 8 and 9. Because I use miniservos, I had to fill in the standard-size servo openings. The kit's extra servo-reinforcement piece did the trick.

There are two wing-mounting options: one uses functional scale flying wires, and the other uses hooks and elastic—sailplane style. I chose to use the bracing wires. Bolt tail skid 38 onto part 23.

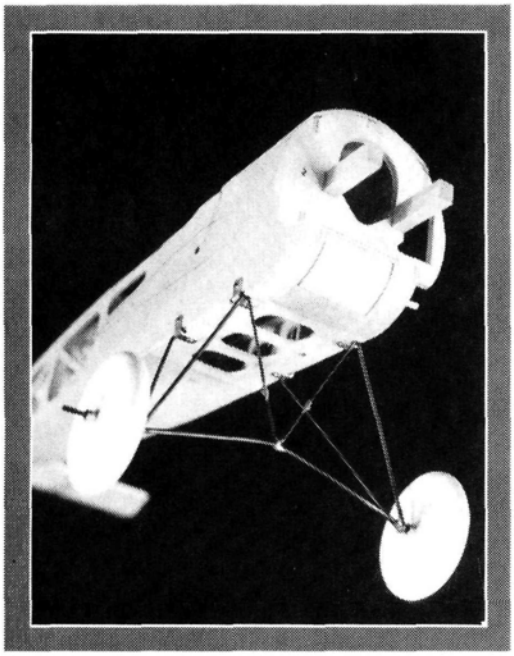
"The Eindecker's performance suits me perfectly. It flies fairly fast, but it's more responsive than a trainer."

EMPENNAGE

To prepare the tail feathers for assembly, you only have to round the stabilizer's edges and trim the elevator to the proper length. A hardwood dowel (54) connects the elevator halves. The vertical fin (40) and the rudder (42) come in two halves that, when glued together, "sandwich" a strong fabric ribbon hinge, which is airtight and invisible. Next, cut 25mm off block 24, and glue it to the fuselage's rear to support the stabilizer.

SPECIFICATIONS

Type: *Scale electric*
Wingspan: *53 inches*
Weight: *60 ounces*
Wing Area: *425 square inches*
Wing Loading: *20.5 ounces per square inch*
Power Req'd: *gear-reduced Graupner 600 BB 7V motor; 7- to 8-cell battery packs*
Propeller: *10x6 Grauper Old Timer (no. GP 210060)*
No. of Channels Req'd: *3 (elevator, aileron, throttle)*
Sug. Retail Price: *$117*
Features: *external quick-change battery compartment; instructions for either electric or glow power; box-fuselage contruction with ply sides; formed landing-gear wire; ABS-plastic cowling and cheeks; two-piece wing with functional flying wires.*
Comments: *the Fokker E-III has an inspiring scale appearance and stable flight characteristics. The excellent die-cutting of its many fabricated parts makes this little bird as much fun to build as it is to fly. The E-III is easy enough for beginners to fly, and its scale appearance will please seasoned pilots. To prevent too much air speed from being bled off (the plane's scale flying wires, landing gear, etc., increase drag), it's best to keep some power on during landing approaches.*



The E-III's nose area is beefy by any standards. Finally, a fuselage and landing gear that are strong enough to support the battery's weight! If the plane crashes, the battery will break through the hatch cover instead of damaging the fuselage.

BACK TO THE FUSELAGE

To determine the wing incidence accurately, draw a reference line parallel to the stabilizer through the wing area. Rib 52 has a hole for pin 60, which goes through the brass tube in the fuselage. Insert the pin and mark the front of rib 52 according to the plan. Now the rib can swivel in place. To establish an incidence of 1 to 1 1/2 degrees, raise the front of the second guideline (or lower its rear) 5 to 5.5mm. When you've established the incidence, drill a 4mm hole in the rear of rib 52 to accept the hardwood dowel.

Before you attach the fin, I suggest that you cover the stabilizer and then glue and hinge the elevator, because they're inseparable when the fin has been glued into place. Glue more 5mm scrap between the firewall and bulkhead no. 4 to support the 2.5mm balsa-sheet cover. Shape this as shown on the drawings.

I cut out all the vacu-formed plastic parts with aviation snips. To assemble the landing gear, attach the formed-steel parts to the fuselage with mounts made of 1x8 aluminum that's bent and drilled. You can hold the gear in place permanently with 20 turns of fine-steel wire and silver solder. The wheels are drilled to accept the brass inserts, but I had to drill the insides of my inserts more so that they would fit onto the axles. The cabane is made of the long, 1x5mm aluminum stock, which you drill and bend as shown on the drawing. Slot the fuselage's top to accept the cabane, and attach it using the supplied screws.

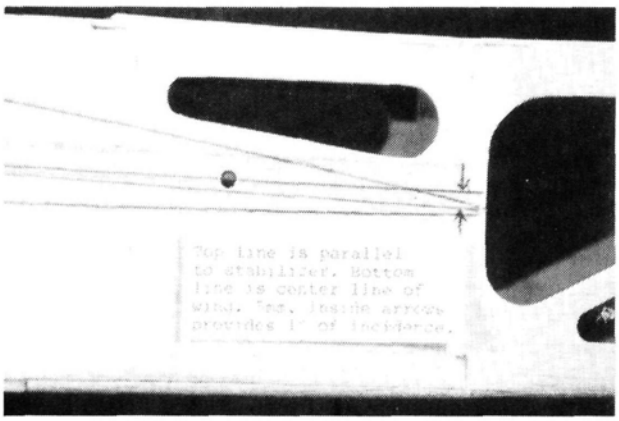
WING

Wing construction is typical and straightforward, and the balsa and die-cut, notched parts cut building time dramatically. Simply pin the spar, the trailing edge and the leading edge into place, and glue in the ribs with thin CA. (Note: I couldn't find any instructions on how to make the guide-wire supports (58) for each wing, so I made some of 1/16-inch birch plywood.)

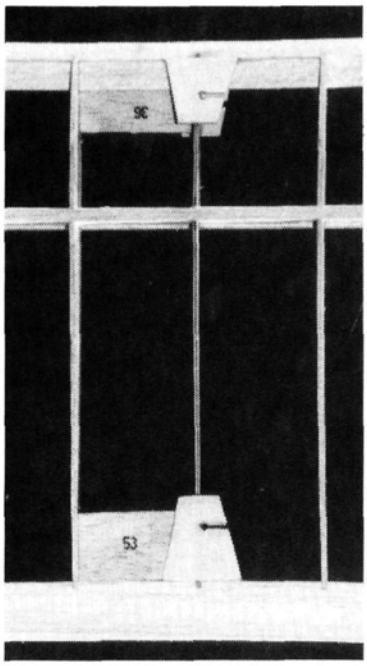
You install the webbing (47) at mid spar and only at bays 3 through 9. The dihedral angle will depend on where you drill the holes for the small brass wing-mounting tubes. I found that the dimples were in the proper places when I raised the wing tip 20mm. Surround the tubes with scrap balsa to fill the holes and to give the tubes more support. Consult the plans to learn the length of the four wing-mounting tubes.

To brace the wing, solder eight pieces of aircraft cable to the threaded bushing (d). Then cut four 6mm pieces off the small brass tube, and use them as "crimps" to attach the cable to the cabane and the landing gear. Be careful not to disturb the wing's geometry.

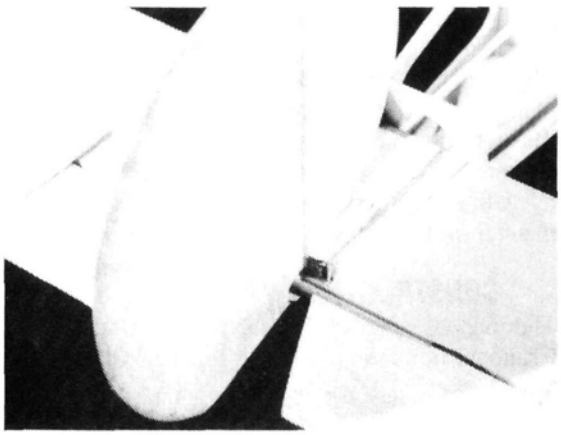
I assembled all the ABS plastic parts using Pacer* Plasti-Zap, and I painted them with Testor's* flat military enamels. I painted the



You have to build the appropriate incidence into the wings, and this step gives you a better understanding of aerodynamics.



On this section of the wing, you can see the guide-wire supports. I made mine from scrap ply and mounted them as shown on the plans.

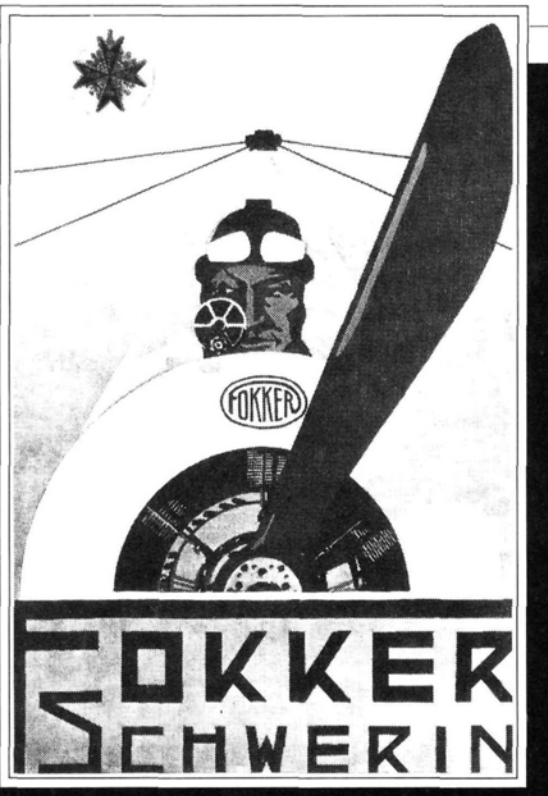


The tail feathers have an invisible hinge line and a dowel elevator connector. Here, the fuselage rear has been filled in, and it's ready for the top part (22).

Early in WW I, the infamous Max Immelmann was quoted as saying: "When Allied aircraft appear, the best defense is a speedy retreat."

Inspired by the French Morane-Saulnier H monoplane, Tony Fokker designed and built the first Eindecker (single-wing) prototype, which was designated the "M-5." It was basically a utility aircraft, and its innovations included a welded-steel fuselage and a superior high-lift wing. The combat E-I models soon emerged, armed with machine guns that were syncronized to shoot through propeller blades. Consequently, pilots of the Eindecker I and II were usually able to take offensive positions even though often outnumbered.

By August 1915, the first of about 500 E-III's were "dog-fight-ready" on Germany's western front. Powered by the latest 100hp engine and armed with one or two LMG 08/15 Parabellum (Spandau) machine guns, they quickly took dominance of the sky away from the Allies. By 1917, nine Eindecker pilots had been awarded the coveted Pour Le Merite (Blue Max), including such great heroes as Boelcke and Immelmann, who was a Knight of five different "orders." Until the introduction of the deHavilland DH2 and the Nieuport II, British fliers spoke of the "Fokker scourge" and described themselves as "Fokker fodder."



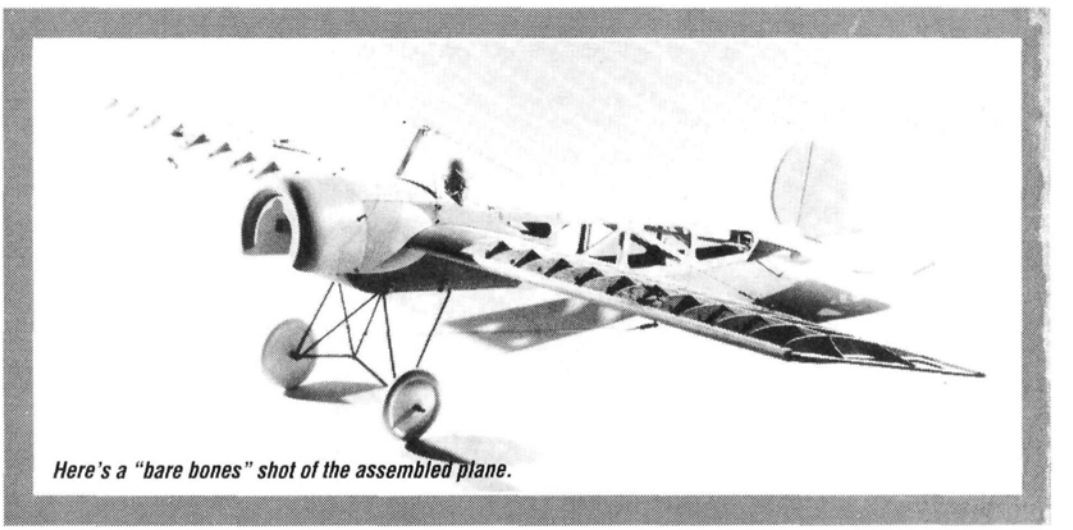
FOKKER SCOURGE

Spandau guns black and, for authenticity, I used several shades of brown for the pilot's clothing. Before covering the plane, I suggest that you test-fit the cowling, the cheeks, the fin and the hatches, and then remove the landing gear.

COVERING AND FINISHING

I covered my E-III with Hobby Lobby's Superfabric because it looks authentic. If you plan carefully, you can cover the entire model with just one roll (although I did it differently).

Instead of covering the tail feathers and the fuselage's top, I painted them with four coats of Pactra* Sanding Sealer. Using Superfabric on the wings and fuselage sides made it easy to cover the tough spots, i.e., the wing tips. To make a fairly realistic E-III color, I used a mixture of one part Cub Yellow and one part Curtiss Blue dope. (I suggest spray application.) A light application of Coverite's* Black Baron Glosskote has just the right reflective qualities. I used Coverite trim sheet to make the white square patches, and I applied the kit's decals to them for the finishing touch.



Here's a "bare bones" shot of the assembled plane.

RADIO INSTALLATION

Airtronics'* new lightweight flight package was available just in time for my first flights. Weight is a major consideration, and Airtronics' $^{7}/_{8}$x$^{15}/_{16}$x2$^{1}/_{4}$-inch, 1-ounce receiver (part no. 392745) and $^{1}/_{2}$-ounce microservos are certainly welcome aboard my model aircraft any time. The compact gear gave me extra space and enabled me to keep things tidy, which is a bonus.

For throttle, I used Graupner's 20A R/C Power Switch with a receiver-battery eliminator. Later, I incorporated a Jomar* Electronic Proportional SM-4 speed controller without BEC. It requires a receiver battery, and it's a good excuse to try the light 250mAh battery pack from the radio set.

FLYING

Whether the E-III takes off from hard dirt or you hand-launch it while running slowly, let its speed build up in a gradual climb—300 feet of altitude in 1 minute is no problem! Tight turns are immedi-

(Continued on page 71

SPRING

1991 WAR BIRD MINI RENO RACES

Above: Spencer Wallace built his "Rare Bear" Bearcat from scratch, guided only by a three-view drawing from Replatech. Its wingspan is 47 inches, and it weighs 8 pounds. This accurate replica of the famous Reno Racer is powered by an O.S. .61 VF that swings a reworked Rev-Up 11x7.5 prop. Spencer, a master builder, finished this one with MonoKote, using it for the base color, the trim and even the labels. Spencer told me that it took him 4 hours just to cut out the Rare Bear label, and he did it twice before he was satisfied! This beautiful plane has Supra retracts and is controlled by an Airtronics 6-channel Vanguard radio.

Louie Kear took 1st place with his model of the Martin MO-1. Guided by a three-view drawing, Louie scratch-built his winner out of balsa and foam. It's powered by an MDP K&B 6.5 engine. It was modeled after the full-scale bird—America's first all-metal military aircraft. The original was designed in 1924 and manufactured from 1924 to 1927.

by STEVE GURLEY

THE ARIZONA MODEL Aviators sponsored the Warbird Mini Reno race, which was organized by the Scale Warbird Racing Association, at the Spook Hill flying site in Mesa, AZ. The race was held on Friday through Sunday, February 15 to 17. The weather was beautiful, with only a slight breeze across the runway. The sky was a solid blue, and the temperatures were in the low 80s. This was much better than the heat we endured in September '90, when it was 106 degrees in the shade and 166 degrees on the ramp. That was tough on everyone, including the aircraft.

Left: airplanes lined up in the center of the runway every day at noon so that the spectators could vote for their favorite planes.

Below: Ron Saum's P-51 is an EZ Aviation ARF painted as a replica of the Reno Racer "Miss America." It's powered by an O.S. .61 RF.

Scale judging was held on Friday afternoon and evening at the Confederate Air Force Hangar on Falcon Field in Mesa. The best score, 95.5, was given to Dave Linne, for his beautiful Ryan STM. Dave is a member of the Arizona Model Pilots Society.

Photo right: Walter Reeves, of the Phoenix Cardinals football team, also races warbirds. His ACE T-34 is powered by an O.S. .46 SF and has a built-up fuselage and foam wings.

Below: Dave Linne's Ryan ST-M is built from a Byron Originals kit. It has a fiberglass fuselage, foam wings, and it's covered with Solartex. Dave used pinking shears to duplicate the pinked edges of the fabric on the original. It's powered by an Enya 2.4V 4-stroke engine.

SCALE RACING HEATS UP IN ARIZONA

The second part of the scoring was based on lap-time points. The racing points are awarded for each lap, and a perfect lap scores 4 points. Usually, three or four airplanes compete in each heat and, with speeds closing in on 150mph, this can make for some exciting racing! The best scores in six heats of the seven flown make up a racer's total score. A point count of 100 is given for the 4 points earned in each lap. Each pilot's six best scores are averaged. If the pilot gets 4 points consistently, he receives 100 points for Racing. For all pilots, the Racing score is added to the Scale score to determine the overall winner. If there are any ties in the first three places, as there were in this race, the higher position goes to the pilot who scored better in scale outline, color and markings, and craftsmanship, in that order.

Louie Kear, who placed 1st, also had the fastest time, and his MO-1 was judged "People's Choice" as well. Spencer Wallace placed 2nd because his scale outline was given a higher score than Dennis Roper's, even though they tied in Scale and Racing points overall.

There were 65 airplanes and 54 pilots at this event, which is growing more popular every year. Entrants from all over the Southwest showed up at this, the best-ever Warbird and Mini Reno Race, and we expect that this fall's event will bring an even larger turnout. It will be held on October 4, 5 and 6, 1991. If you want any information on the Scale Warbird Racing Association, contact Bob Smith at 343 South 24th St., Mesa, AZ 85204; Tel: (602) 834-5235. ■

Earlier Entries

Some of the notable models that have entered the Warbird Mini-Reno Races in previous years are shown here.

Larry Cranton, who won the spring race last year, built this beautiful Missile Red P-51 Mustang named "Candy Man." It was made from a House of Balsa kit, and it's powered by a Lee Custom K&B 6.5 engine that turns a 9x7 prop. Larry fashioned this aircraft after the full-scale Reno Racer of the same name. The model is finished with MonoKote over a Coverite base. Robart 40-size retracts clean up the airfoil after takeoff and increase the plane's speed enough for it to be a top contender. We're expecting to see this beautiful aircraft at the fall race. Photo right: Spencer Wallace assists pilot Larry Cranton with "Candy Man."

Photo left: Michelle Boland took 3rd place overall with her All Coast Corsair in the Spring of 1990.

Ken Thornton entered his P-39 Q in the Fall '90 race.

Below: Glen Heithold built his P-38 from a Royal kit. It has a 74-inch wingspan and weighs 13 pounds. He runs 2hp.61 engines that turn 11x7.2 props. The body was finished with fiberglass and Feather Fill, and it was painted with Ditzler's Deltron paint. The color is the same crimson as was used on the original. This model is an exact replica of the five-thousandth P-38 built. It's equipped with Kraft Multicon retracts, and a World Engines 7-channel radio controls this beautiful model.

WINNERS

PLACE	PILOT	AIRCRAFT	POINTS
1	**Louie Kear**	**MO-1**	**193.50**
2	Spencer Wallace	F-8-F "Rare Bear"	187.00
3	**Dennis Roper**	**P-63**	**187.00**

YOSHIOKA

Liberty 45

by TIM DIPERI

WHEN I STARTED in this hobby 20 years ago, the only way you could arrive at the field with an airplane that flew well and looked great was to spend countless hours building it. Few ready-to-fly models were available, and most modelers were too proud to arrive at the field with one anyway. Since then, I've built a number of almost-ready-to-fly (ARF) airplanes, so I've seen a full range of products. Yoshioka's* Liberty .45 is one of the best kits I've seen.

THE KIT

The Liberty .45 is a typical ARF kit: the wing panels come completely finished and the wing tips are installed; the ailerons are attached to the torque rods; and the hinges are glued into place.

The fuselage is covered with a foam/Mylar covering and ABS plastic, and there's a reasonable amount of plywood inside it. The vertical and horizontal tail surfaces are ready to be attached to the fuselage. The rudder is the only control surface that has to be hinged (not glued) because you have to install the steerable tail-wheel linkage.

The kit includes many high-quality ABS-plastic fairing parts, a belly, a center top section for the wing, wheel wells, a vacu-formed ABS-plastic pilot figure and a nice fillet for use where the vertical fin meets the empennage. There are also several hardware packages with extremely good die-cut plywood, a tail-wheel bracket, all the necessary pushrods and control linkages and a fuel tank that fits perfectly. The white engine cowling is made of rugged, flexible plastic, and a complete, steerable tail-wheel assembly is also included.

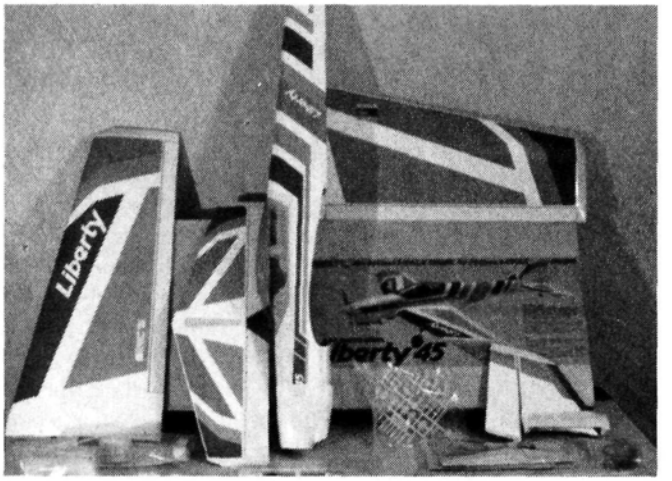
The "manual" is a large 14x16-inch sheet that's folded into four sections, and it has almost 40 black-and-white photos and eight sketches to illustrate construction. Although the instructions are brief, they're adequate, because everything fits together extremely well.

GIVE ME LIBERTY...

Building the symmetrical wing can be confusing. Just make sure that the aileron torque rods point upward, and you won't have any trouble. Before you join the wing halves, you have to laminate two center plywood ribs together and join a strip of plywood to a large balsa spar. The instructions suggest that you use thick CA but, to laminate spar material, I use epoxy. When both parts are dry, trial-fit them. I had to sand the spar slightly to make it fit, but this was mostly because of the epoxy overflow.

After you've established a good fit, epoxy the center rib and the spar to the right half of the wing. The choice of whether you use the right or left panel for this isn't critical. It's extremely important, however, that you

Liberty 45



The Liberty .45 kit is typical of most ARFs and includes: hinged and finished wing halves, fuselage and tail components and all the necessary hardware.

specifications

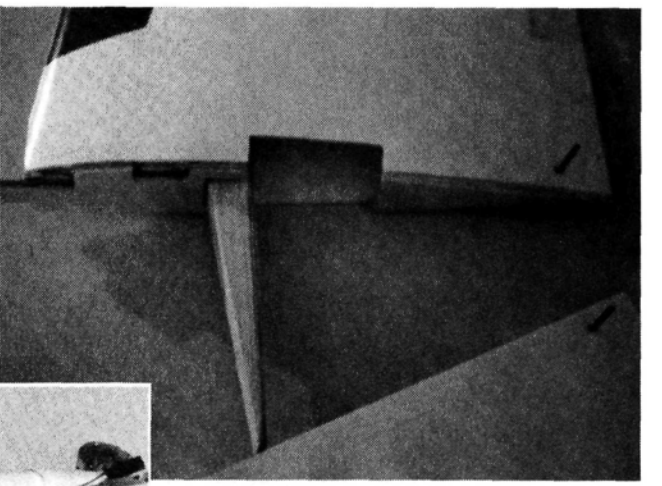
Type: *Sport/pattern*
Wingspan: *57 inches*
Length: *53 inches*
Weight: *84 ounces*
Wing Area: *605 square inches*
Wing Loading: *20 ounces per square inch*
Power Req'd: *.40 to .49 2-stroke; .60 to .70 4-stroke*
Prop: *10x6*
No. of channels Req'd: *Four: throttle, rudder, aileron, elevator (optional fifth channel for retracts)*
Radio: *Futaba 1024 9-channel PCM with an RCD receiver*
Sug. Retail Price: *$350*
Features: *the fuselage and wing halves on this ARF plane have a foam/Mylar finish and, except for the rudder, all of the plane's surfaces are factory-hinged and finished. The kit has many high-quality ABS-plastic fairing parts, including a cowling and retract wheel wells. Its rudder has a pull/pull control setup that provides slop-free operation.*
Comments: *the Liberty .45 tracks well during takeoffs and performs aerobatics easily. It slows quickly and has good slow-speed characteristics that make landings a breeze.*

distinguish between the top and the bottom of the spar before you epoxy it to the wing half because its position determines dihedral. Don't be stingy with the epoxy when you glue these parts. I used 5-minute epoxy, and I held the two panels together to ensure that they were properly aligned while the epoxy was drying. This is the most critical part of the wing assembly—a misaligned wing will adversely affect flying performance.

You have to trim the top center of the wing slightly to accommodate the plastic wing-center covers (specifically, the top one). Glue on the center-section cover with thin CA. Although you don't have to trim the bottom of the wing to accommodate the cover, you do have to drill holes in it for the wing-mounting bolts. Do all this slowly, and before you apply CA, check that everything fits properly with the fuselage. Before you drill the mounting-bolt holes in the wing, you must laminate the mounting blocks and epoxy this assembly into the fuselage. There are slots in the fuselage that enable you to position the assembly correctly, so this is a fairly straightforward procedure.

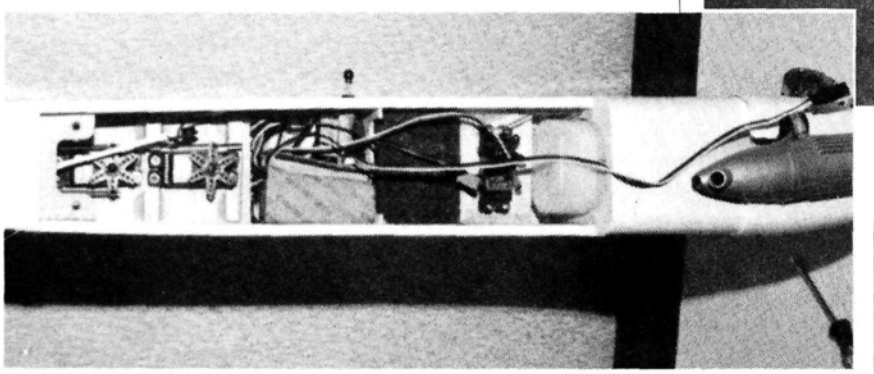
When I was satisfied with the fit and position of the wing, I realized that the mounting bolts could easily pull through the balsa trailing edge. Although there's nothing in the instructions about it, I reinforced this area with a 1x2 1/2-inch piece of 1/8-inch plywood.

Unless you plan to use retracts (I use Rhom-Air* retracts), the next step is to install the landing gear. Mount each wire



In this photo, the wing halves are ready to be joined, and you can see the plywood joiner and the wedge. Be sure to use plenty of glue when you join these parts.

gear into a 1/2x1/2-inch hardwood block. Then, epoxy one assembly into the mounting area in each side of the wing. If you use retracts, install them according to their instructions.

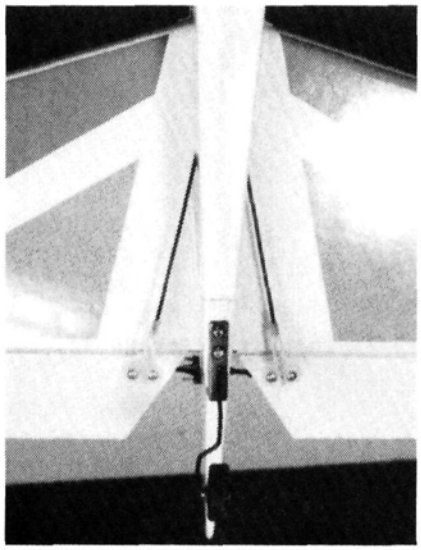


The radio installation is straightforward. Notice that the throttle servo has been installed behind the fuel tank.

FUSELAGE FULFILLMENT

The first thing you install in the fuselage is the fuel tank, and the die-cut bulkhead accommodates it nicely. It was also easy to mount my Magnum* .45 engine on the two factory-installed, thin-plastic mounting plates, which are held to the plywood engine mounts by eight screws. The back of the propeller must be 20mm from the front of the engine mount so that the spinner can clear the cowling. You mount the engine at about 135 degrees from vertical, and this makes it convenient to route a muffler or a tuned pipe out through the bottom of the cowling.

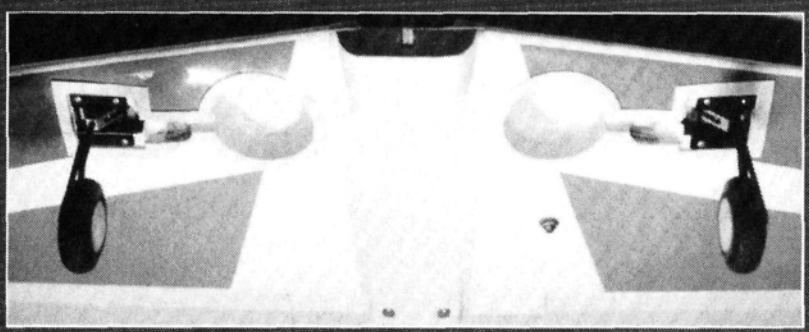
I had to trim a lot of material off the cowling when I installed it, but this was easy using a Dremel* drum-sanding tool. When I was satisfied with the cowling's fit, I drilled three small holes in it for the sheet-metal screws that are used to mount it on the fuselage. The kit also supplies decals that extend the fuselage stripe onto the cowling.



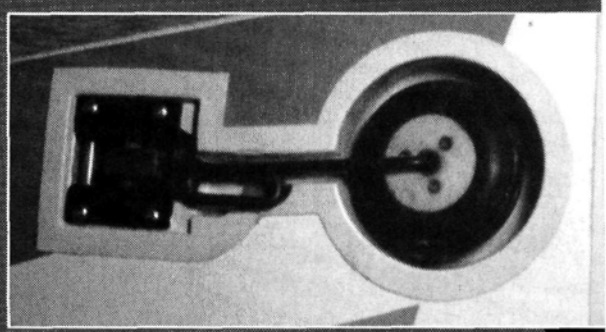
Here you can see the dual elevator-pushrod wires. You bend them into a "Y" shape and connect them to a dowel pushrod.

The elevator pushrod is a hard-balsa dowel. You have to drill it to accept two partially threaded wires that extend toward the airplane's tail and one un-threaded wire that extends toward the radio compartment. Bend the threaded wires to form a "Y" so that you'll be able to control each side of the elevator. Carefully mark the places where the wires should exit the fuselage, and cut a small slot for each one. Route the two kit-supplied plastic tubes through the slots, attach them to the threaded rods and pull the rods through the slots using the tubes.

Epoxy the plywood plate to the rear of the fuselage, and epoxy the empennage to the top of the plate. Next, attach the control horns to the elevators and then to the pushrods using the nylon clevises. When you epoxy it to the empennage, it's important to keep the vertical fin straight and at an exact 90-degree angle to the horizontal stab. Use CA to glue the vacu-formed stab-root cover to the empennage and the vertical fin. Attach the tail-wheel assembly to the fuselage with the self-tapping screws, and cut a slot in the rudder to accommodate it. Epoxy the rudder to the hinges and the tail-wheel



The kit has instructions on how to install the retracts. Notice the air fitting on the underside of the left wing half.



When retracted, the gear sits nicely in the vacu-formed plastic whee well, which is glued in place with thin CA.

RIGHTEOUS RETRACTABLES

Considering the Liberty .45's nice lines, it would be a shame not to use retractable landing gear. (If you plan to use retracts, start the procedure before you join the wing.) I chose Rhom-Air retracts for two reasons: they don't need a special 180 servo to work; and I happened to have a set on hand. Although my retracts are pneumatic, the wing can easily accept mechanical retracts, and the manual even has instructions on how to install them.

The Rhom-Air retracts fit into the factory-built supports in the wing, and I only had to trim the gear-mounting rails slightly to accommodate them. I mounted the gear temporarily to see where the wheel would retract into the wing. The Rhom-Air wheel strut is adjustable, so I didn't cut any material out of the wing at this point.

The Liberty .45 kit provides vacu-formed plastic wheel cups so that the wheels are retracted into a clean, neat area. You have to cut the wing panels to install the cups, but before you glue them into place, be sure that the gear

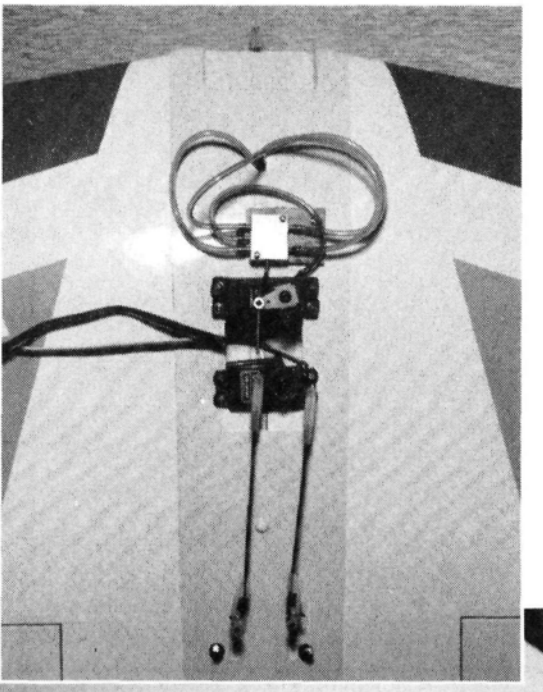
assembly.

The rudder uses a pull/pull control method. You run thin steel cables through plastic tubes to each side of the vertical fin. Then you connect the cables to the rudder-control horns with Z-bend fittings and threaded fittings.

I use Futaba* S-130 servos for the rudder, and they fit in the factory-installed servo tray perfectly. I neutralized the servo, adjusted the two cable wires and secured them to the Z-bend fittings. I centered the rudder and turned the clevises inward to tighten the cables. This setup provides slop-free rudder control.

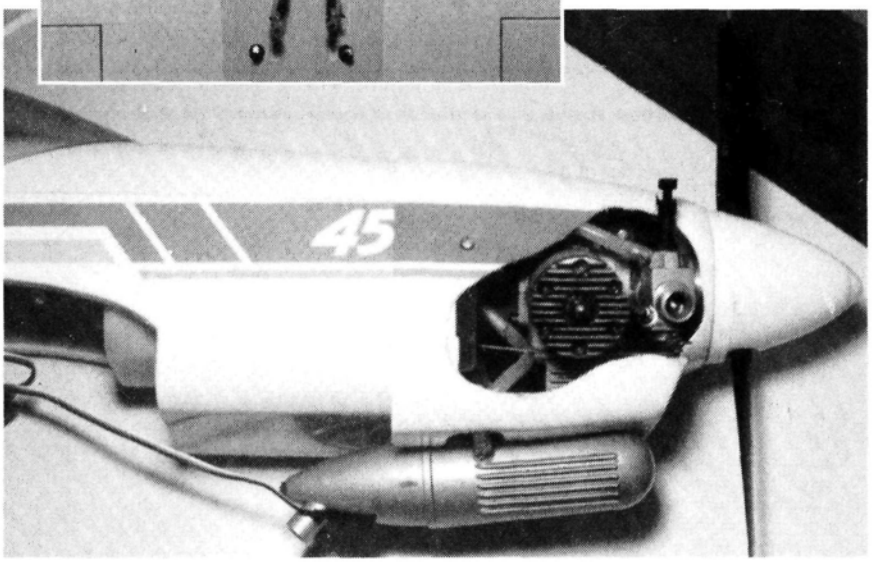
To raise the elevator servo slightly, I glued two small strips of wood to the servo tray, and I attached the servo arm to the elevator pushrod using the Z-bend in the music wire. To install my retractable landing gear, I had to move the factory-installed throttle-servo mount forward because it interfered with the retract servo. I mounted the aileron servo horizontally instead of vertically (which is the usual way to mount strip ailerons). Because of this, the pushrods are slightly offset, but it hasn't caused any adverse effects.

I used an RCD receiver for the Futaba servos. My 9-channel Futaba radio has a PPM (positive pulse modulation) feature, and it provides excellent control.



Left: the aileron servo is mounted horizontally and connected to the control surfaces with a torque-tube linkage. Notice the air valve and the retract servo.

Below: the Magnum .45 engine is mounted so that the exhaust exits through the bottom of the cowling.



fits and retracts properly.

Before I joined the wings, I secured the gear and mounted the retract air tank in the wing. I wanted *everything*—including the retract servo—to be installed in the wing. I also mounted the pneumatic tank valve on the bottom of the wing from the inside. Next, I joined the wing halves, and I kept the air lines long, because I hadn't determined the exact position of the air switch yet.

I mounted the aileron servo and, as I mentioned in the main article, it's slightly offset to accommodate the retract servo. I mounted the retract servo and the air switch just in front of the aileron servo. I've always found it difficult to adjust the linkage so that the servo actuates the valve properly, so I used the program mix on my computer radio to position the valve precisely.

The retracts work well and, in addition to reducing drag slightly, they really add to the plane's appearance.

LIBERTY LEVITATION

On the day of the test flight, the wind was blowing hard and, at first, I was a little apprehensive. I smoothly advanced the throttle and, even on a bumpy field, the airplane tracked as if it were on rails. I applied some up-elevator and the plane's first voyage began.

I thought it would be easier to control the ailerons and the elevator with VTR (variable travel rate) instead of with dual rate, and I was right. Not only was the control response extremely comfortable, but the plane needed absolutely no trim.

The airplane reacted very positively, and the powerplant seemed to be more than adequate. It easily executed a number of vertical maneuvers, as well as loops, rolls and pattern maneuvers. It tracked very well—with no bad tendencies—and it only needed a little down-elevator to sustain inverted flight.

During the landing approach, I was surprised by how easy it was to slow the plane down. It displayed a stable sink rate without any tendency to tip stall, even in the turbulent conditions.

(Continued on page 71)

QUIET FLIGHT

(Continued from page 46)

JUNE 29-30th: The Boeing Hawks 9th Annual Electric R/C Fly-In, in Kent, WA, is the largest electric "fun-fly" event in the Northwest. For more information and available flying frequencies, call Bernard Cawley at (206) 839-9157, or Ben Almojuela at (206) 283-3407.

Till next time, good thermals and full charge! ■

THE SHOOTER

(Continued from page 33)

As always, test the adhesive on scrap material to verify that it's compatible with the cores and the sheeting.

Trim the sheeting to its final size and glue on the 1/4-inch leading-edge cap. Cut the fin and elevons out of balsa. Sand the wing panels to shape and join them with epoxy.

Cut out and epoxy the gear blocks into place, then install the wing tips and join the wing to the fuselage. Trim and sand all the parts, cover them with your favorite material, and epoxy the fin and the cockpit into place.

FINAL STEPS

Install the radio and the engine. Set the elevator trim at neutral and, to provide the reflexed airfoil required for flying, adjust the elevons so that they're about 1/8 inch above the point that you'd usually consider neutral.

When you set the height of the nose wheel, make sure that the leading edge of the wing is 3/8 inch higher than the trailing edge (measured at the hinge line). This will provide a positive, static angle of attack, while the plane is sitting on a flat surface.

Following the plan, balance the Shooter before you fill the fuel tank. Unlike some designs, the weight of the fuel isn't a concern because it won't appreciably alter the plane's CG point.

If you build according to the plan and follow the suggested construction sequence, your Shooter will be a rewarding and totally new experience. Welcome to the unique world of tail-less flight! Let me know how you enjoy it.

**Here are the addresses of the manufacturers mentioned in this article:*
K&B Mfg. Inc., 2100 College Dr., Lake Havasu City, AZ 86403.
***Soaring Research,** 454 Wildrose Ln., Bishop, CA 93514; tel: (619) 873-4932.*

(Continued on page 68)

THE SHOOTER

(Continued from page 66)

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
JR; *distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*
Corefilm; *distributed by Soaring Research.* ■

GIANT STEPS

(Continued from page 45)

tic hinges can be glued into place with thin CA, and they don't require a lot of cutting and shaping (another good idea from a company that's already introduced many good ideas to the marketplace).

The Model Expo at Puyallup was a pleasure as usual. I always enjoy visiting Washington state, and even more so when I can spend several days there with other modelers.

Next month, I'll have some interesting news about a large aluminum Ford Tri-motor model. I'm sure that you'll be as excited as I was when I first heard about it.

**Here are the addresses of the companies mentioned in this article:*
Proctor Enterprises, *25450 NE Eilers Rd., Aurora, OR 97002.*

(Continued on page 71)

GIANT STEPS

(Continued from page 68)

***Bryon Originals,** P.O. Box 279, Ida Grove, IA 51445.*
***Sig Manufacturing Co.,** 401 S. Front St., Montezuma, IA 50171.* ■

EINDECKER

(Continued from page 53)

ate, with the wings almost vertical—you'd think this plane had ailerons. Gentle turns are preceded by a momentary delay, and if you enter from half a loop, the E-III will fly inverted with half-stick down. Its sturdy landing gear has virtually no spring, and with its big narrow wheels, it's best to land it on grass or a runway. Enter the final approach with a lot of power because, when you cut the power, this high-drag plane thinks it has air brakes. (This makes it great for short fields!)

OVERVIEW

This kit offered the challenge of soldering metal and adjusting incidence and dihedral angle, yet I built this plane quickly, so I didn't lose interest in it.

The Eindecker's performance suits me perfectly. It flies fairly fast, but it's more responsive than a trainer. With my help, a beginner flew it—no problem! In fact, it's so easy to fly that the speed controller proved to be an unnecessary expense. I plan to re-install the power switch.

I've taken my E-III to many flying sites, and the comments I've heard are always the same: "Hey, would you fly that now? Nothing fancy, I just want to see it in the air. By the way, did I ever tell you about my first R/C plane…?"

**Here are the addresses of the companies that are mentioned in this article:*
***Hobby Lobby International,** 5614 Franklin Pike Cir., Brentwood, TN 37027.*
***SR Batteries,** P.O. Box 287, Bellport, NY 11713.*
***Pacer Technology and Research,** 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
***Testor Corp.,** 620 Buckbee St., Rockford, IL 61104.*
***Coverite,** 420 Babylon Rd., Horsham, PA 19044.*
***Pactra Inc.,** 620 Buckbee St., Rockford, IL 61104.*
***Airtronics Inc.,** 11 Autry, Irvine, CA 92718.*
***Jomar Products**, 2028 Knightsbridge Dr., Cincinnati, OH 45244.* ■

LIBERTY .45

(Continued from page 65)

CONCLUSION

The Liberty .45 is an excellent kit. All of its parts fit properly, and you can assemble it easily and quickly (about 12

(Continued on page 75)

SPORTY SCALE

TECHNIQUES

by FRANK TIANO

What's up-and-coming

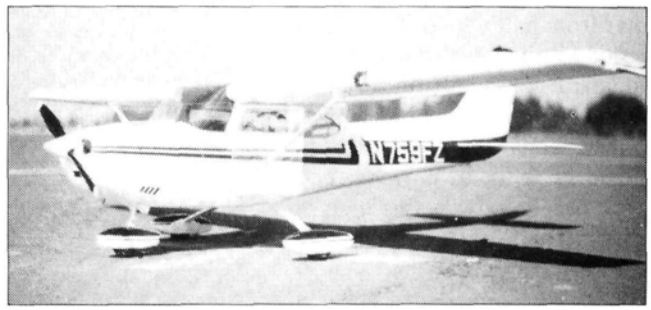
HOWDY, scale fans! This month's column deals with absolutely nothing other than brief comments on some of the most important developments in our fast-growing sport. Next month, I'll return to a "how-to" format, and I'll answer some of the many letters I've received over the last few weeks.

NEWSBREAKERS

L.A.W. Racing Products*, the manufacturers of that really neat transmitter tray I showcased several months ago is now in the scale kit business. That's right—L.A.W. offers a selection of 16 scale kits imported from Europe. If you send them a self-addressed, legal-size, stamped envelope, they'll send you a list of particulars. For now, let me tell ya that they have two sizes of Extra 260s, an Ultimate 300, a Liberty Sport that spans 83 inches, a 90-inch Cap 20, a pair of Diabolos (84- and 91-inch span), a couple of Zlins, a J-3 with an 111-inch span, an 88-inch Yak 55 and a WW II ME-262 twin-engine jet fighter that spans 82 inches. I'll have pictures in a few weeks, and I promise to share some of them with you as soon possible.

OK, we have a race! Tom Easterday of R/C Unlimited Racing* informed me that the big race for 100-inch Reno-type racers is a definite "go," and it will be held in Madera, CA, on October 4 to 6. From what I understand, there are already more than 40 big racing aircraft being completed throughout the country. I'm also told that very few kits meet the race's rule requirements. There are, however, several plans available for those who don't mind scratch-building. A couple that readily come to mind are the 100-inch Bearcat and the Corsair—both designed and sold by Nick Ziroli*.

For those who are interested, quite a few aircraft have been flown in the Unlimited division at Reno at one time or another. I did some research and came up with: the P-51 Mustang (models A, D and H), the Grumman F8F Bearcat, the Douglas Skyraider, the Hawker Seafury, the Vought F4U Corsair, the A-26 Invader, the P-39 Airacobra, the P-63 King Cobra, the P-47 Thunderbolt, the F7F Tigercat, the P-38 Lightning, the P-40 Warhawk, the Yak-11, the Fiat G-59 and, of course, the Tsunami. Just like Top Gun and the Scale Masters, this event should do a lot to promote our sport of scale modeling and squash any ideas that we're just a bunch of overgrown kids playing with toy airplanes! If you'd like more information on the Reno Unlimited, check out my column in the May issue.



Shane Cramer's Pica Skylane uses a Webra 91 Speed for power and turns a Zinger 14x6 prop. The 86-inch Cessna weighs only 12½ pounds. The on-board self-starter doubles as a useful nose weight.

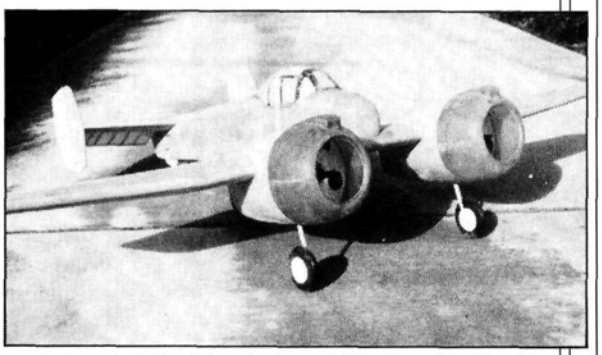
Just a teaser of what you'll see at Top Gun '91. English pilot David Toyer (left) shows his ¼-scale Hurricane to the static judges at a contest somewhere in England. Look for more on the "Hurri" and lots of other good stuff in just a couple more issues!

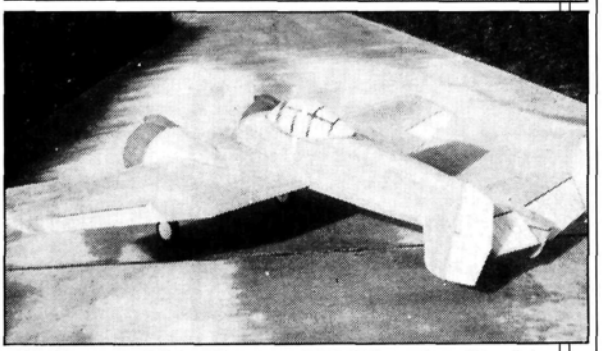
JET JOCKEY

Briefly, if you're getting into jets—you know, ducted fans—and you'd like to belong to an organization that may be able to help with events, techniques and comradeship, check out the Jet Pilots' Organization*. Ralph Bailey, an AMA district rep, is the founder and chairman, and he'll send you all the poop on how to join and receive your very own special membership number. If you fly jets—especially scale jets—you shouldn't be walking around, let alone flying, without a JPO number!

BLOWN-UP ROCKET

Many, many years ago, my good friend Nick Ziroli designed a 60-inch model of the Grumman Skyrocket. This little twin was





Bill Johnson's finished Grumman Xf5f-1 Skyrocket will weigh about 20 pounds and use a pair of S.T. 2500s for power. The fuselage, tail group and engine nacelles are silver, and the main wing is a bright, highly visible yellow.

the forerunner of the famous Grumman Tigercat, which was developed at the close of WW II. Anyhow, why Nicky designed this ugly duckling is really way beyond me, but I do remember that back in the '60s a lot of guys were experimenting with various kinds of wild vegetables. So, I don't think many sets of plans were sold. In fact, if my memory serves me correctly, I think I remember someone saying that maybe 13 sets were sold over five years!

What a coincidence that a buddy from Fort Lauderdale—Billy Whiteshoes Johnson—bought one of those sets of plans and recently had them blown up to 90 inches. He made his own version of a canopy by trimming and paneling a Vaillancourt (Vailly Aviation*) P-47 canopy, and he had a couple of fiberglass cowls made. Tom Cook of Jet Model Products* provided the retracts, and the power comes from a pair of Super Tigre 2500s, although I'm quite sure a pair of 90s would be fine. I thought you might get a charge out of seeing Whiteshoes' rocket, and I'll give you another peek just as soon as he finishes the paint job.

MIAMI NICE

Everybody knows I believe in the truth of the Dave Platt saying that there are only two kinds of airplanes in this world—fighters and targets! Every once in a while, someone comes along with an outstanding civilian airplane that makes you sit up and notice. Well, that someone is my good friend and sometimes big brother from California (soon to be England), Shane Cramer. As long as I've known Shane, he has loved WW II "heavy metal" air-

Denny DeWeese holds up one of the perks you get if you join the Jet Pilots' Organization.

SPORTY SCALE

craft. He's best known for his Thunderbolts, Corsairs and Spitfires—certainly not for his Cessnas, Pipers and Beechcrafts! Well, somehow Shane got a hold of a Pica* 1/5-scale Cessna Skylane and talked himself into doing his usual outstanding job of building and finishing. Talk about a superb effort! Some of the neat, "trick" stuff he's done includes the installation of strobe lights, complete running lights, an exact scale dashboard with working instruments, an operating fuel gauge, remote-control door openers, scale operating flaps and an on-board

"After flying this baby at Top Gun, Shane will have to sell it..."

self-starter. After flying this baby at Top Gun, Shane will have to sell it because he can't find the room to ship it to England with the rest of his stuff! It's a picture like this—of a model like this—that sure makes this job very worthwhile. Good luck, Shane, we'll sure miss you.

So, another month has come and gone. In just a couple more issues, Major Tom will give you all that good Top Gun stuff. I can hardly wait myself! Until next time, I wish you safe flying and good color-chip matches. Oh yeah, if your six needs checking, go ahead.

**Here are the addresses that are pertinent to this article:*

L.A.W. Racing Products, *1229 Capitol Dr., Addison, IL 60101.*

R/C Unlimited Racing, *565 Mercury Ln., Brea, CA 92621.*

Nick Ziroli Models, *170 Oval Dr., C. Islip, NY 11722.*

Jet Pilots' Organization, *3088 Bragg Blvd. NW, Orangeburg, SC 29115.*

Vailly Aviation, *18 Oakdale Ave., Farmingville, NY 11738.*

Jet Model Products, *304 Silvertop, Raymore, MO 64083.*

Pica Enterprises, *Inc., 2657 NE 188 St., Miami, FL 33180.* ■

LIBERTY .45

(Continued from page 71)

hours, if you install retracts). With retracts, you can put this plane in the air for about $500 (excluding the radio), and I think this is good value. I intend to fly my Liberty .45 in the Sportsman Class this year.

**Here are the addresses of the companies mentioned in this article:*
Yoshioka; *distributed by Hobby Lobby International, 5614 Franklin Pike Cir., Brentwood, TN 37027.*
Rhom Products Mfg. Co., *908 65th St., Brooklyn, NY 11219.*
Magnum; *distributed by Global Hobbies Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728.*
Dremel, Div. of Emerson Elec., *4915 21st St., Racine, WI 53406.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

HELI CHALLENGE

(Continued from page 113)

fly the fore/aft cyclic, you might overpitch the heli's nose upward or downward. If this occurs, let the helicopter fall briefly to regain air speed, and pull on the back cyclic so that the machine returns to an upright position. Stay alert during the maneuver so that you'll be able to recover the heli safely if it ends the roll in the wrong attitude.

PRACTICE MAKES PERFECT

There's a maneuver called the "split-S" that you might want to try a few times before you attempt the full roll. Roll the helicopter onto its back and pull back the cyclic until the heli's nose is level again. This will give you some practice recovering from trouble before you actually get into it. One bad habit that many pilots develop is pulling the nose high at the beginning of the roll. This won't help you maintain altitude through the roll, and it

(Continued on page 80)

GOLDEN AGE
OF RADIO CONTROL

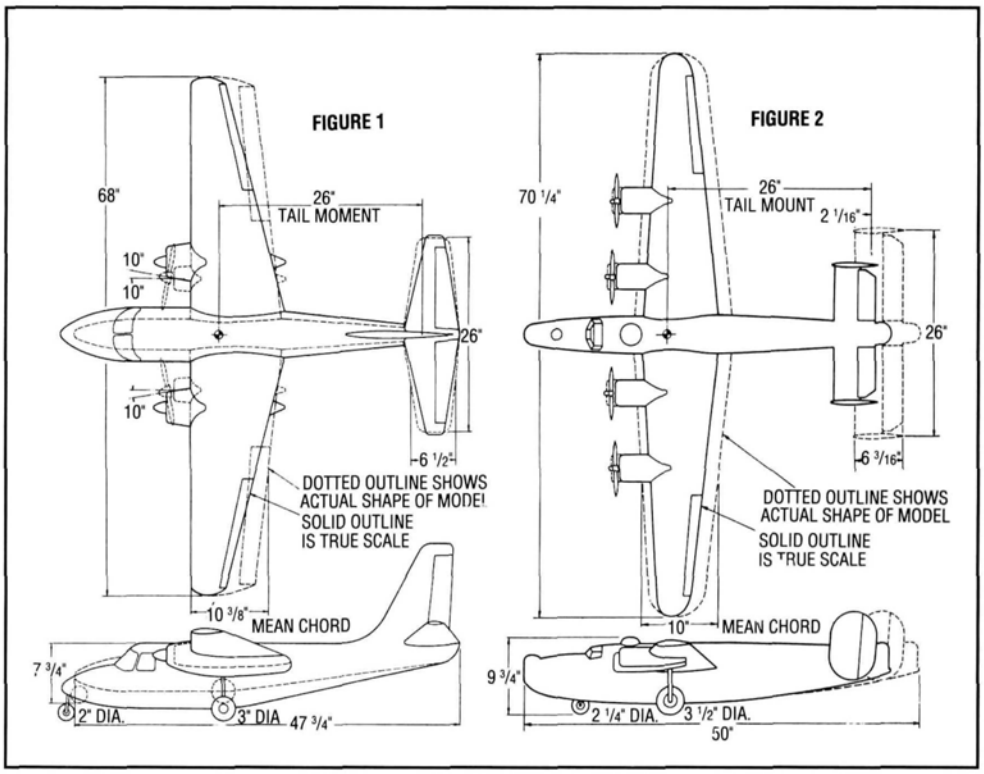
by HAL DEBOLT

Marvelous multies and Bob Noll's notables

"ONE THING LEADS to another" is a cliché that seems particularly appropriate following my recent discussion about the Aero Guidance Society of Endicott, NY. Society members wrote to say how much they enjoyed the piece, and I hope other pioneering clubs will be inspired to send me information so that I write about them.

I mentioned that at least three or four of the club's original members remain active, and a September '64 issue of *American Modeler* included an article by one of them: Ralph Jackson described his experiences with two of the first multi-engine, scale R/Cs. Ralph had enjoyed flying an Aero Commander twin and then a four-engine B-24, with which he did well at the '63 Nats. Today, we know about the problems multi-engines cause us, but we also appreciate their performance. Doing this in the early '60s meant that Ralph was venturing into uncharted territory with equipment handicaps that most of us today would consider unsurmountable. Consider the not-too-reliable radios and the vibration-prone engines (often more than one), and remember that our neat carburetors had yet to come.

Bob Noll with his first R/C—a Berkley-kitted Royal Rudder Bug.



Three-views show how practical Ralph Jackson's choices of models for multi-engine operation were. They were probably firsts for R/C.

HE HAD A DREAM...

With so many obstacles in his way, only an outstanding, innovative modeler with a dream to fulfill would have put the necessary effort into such projects. We now know that he was fairly successful, and some outstanding flying led others to follow.

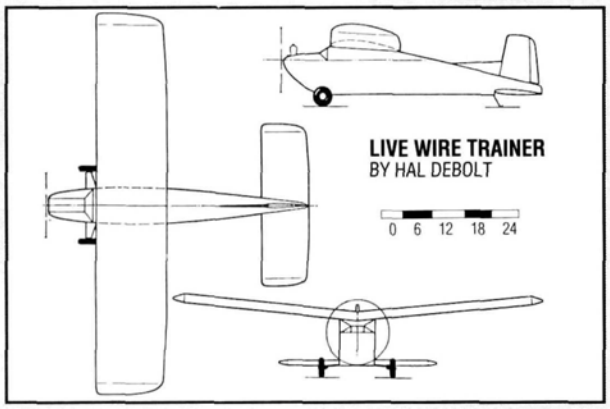
It's interesting that both of Ralph's models had spans in the 6-foot range and performed well with wing loadings of approximately 24 to 27 ounces per square foot—far above the norm for that time. Ralph also showed how little power is actually needed when several engines are used. The Aero Commander performed well with just two .19s, and the B-24 had more than enough with four .15s. Ralph was amazed that the B-24's flight was realistic and positive with only two of the .15s operating.

Ralph was smart enough to realize that, to be successful, he'd have to match most of the full-scale craft's controls. He knew he'd need rudder, aileron and elevator controls as well as reliable throttle

VINTAGE R/C PROJECTS

I always want to bring to your attention good vintage R/C projects, so I'm pleased to present two of the first R/C kits offered—the Live Wire Trainer (which came first) and the Trixter Beam—both remarkably similar in concept, yet most distinctive in appearance.

Their design reflects the nature of early R/C. With only single control (which was by means of a sequenced escapement), the most that could be expected was an ability to guide the model.



A three-view of the Live Wire Trainer—the first R/C kit.

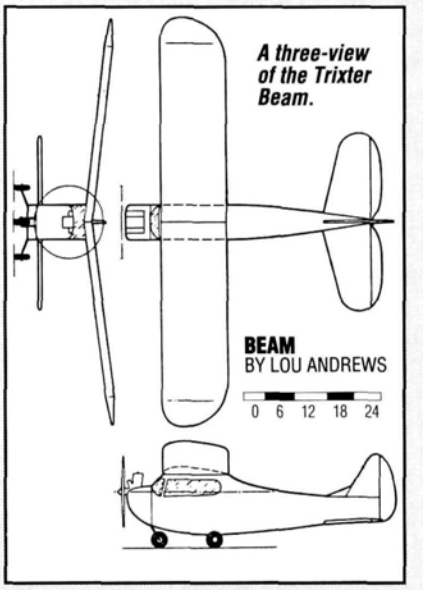
Models had to fly themselves, and recovery had to be automatic (to get them out of the trouble novice pilots sometimes got them into!). Though this might sound like guided free-flight, it went beyond that; there was a need for low flying speeds, and there was the extra weight of the heavy R/C equipment.

To ensure recovery, excellent spiralling stability was vital. Both designs show the strong influence of Charles Hampson Grant's philosophy. At that time *MAN* Editor "Charlie" Grant was the model-building guru whose "basics" were accepted as the golden rules of model designing. The models' general designs, their moment arms and their "guppy" appearance came from Grant's book.

Henry W. Wieler in the early '50s with his version of the Beam.

They both had spans of approximately 4 feet and were powered by .09s. Their remarkably low weight of 2½ pounds gave a 12-ounce wing loading that increased the need for low speeds. A major difference between the two was that the Live Wire used a removable "R/C unit" that could be switched from one model to another.

The Live Wire Trainer was produced by the deBolt Model Engineering Co. of Williamsville, NY, in considerable volume, and its success led to many other Live Wire designs. The Trixter Beam was designed by Lou Andrews and produced by the Paul K. Guillow Co. of Massachusetts. It, too, sold well and led Andrews to form his own production company to make R/C kits (notably, the "Ray" series and the famous Aeromaster biplane).



A three-view of the Trixter Beam.

Obviously, made with today's materials and using today's controls, these models would make fine fliers that would be easy to identify as being of the early R/C era.

control for the engines (in the days when rudder, elevator and engine control was considered more than enough for single-engine types!). He built his twin first and was successful with the Aero Commander engines. Having proved that it could be done, he moved on to the four-engine B-24, but he soon discovered a problem he hadn't anticipated: how could he start and tune all the engines properly for flight? Remember: there were no engine starters then!

When you hand-start engines, you depend so much on what you *hear* to decide your next move, and it's difficult to hear what one engine is doing when another is screaming right next to it! Fortunately, when an engine has been properly adjusted and warmed up it can be shut down and will usually start with just a couple of flips. Ralph had to start one, tune it and shut it down, then get the second one peaked; after that, he started the first one again. This approach worked with two engines, but how about four engines?

DOUBLE YOUR FUN?!

When Ralph tried to start the B-24's *four* engines, he found that, by the time he reached the fourth one, the first had cooled so much that it wouldn't start

(Continued on page 78)

GOLDEN AGE

(Continued from page 77)

Yes, that's snow!—but it didn't stop the Aero Guidance Society members from flying. Bob Noll with his '57 LW Champion.

instantly. What did he do? His solution was simple: someone else started the third engine while he started the first one; then they shut them down and started the second and fourth engines. Obviously, when two or three engines were running, the noise was considerable, but patience apparently prevailed.

With only one channel available for engine control, one servo had to operate all throttles simultaneously. Ralph spent many hours adjusting, tuning and getting the engines to operate together. Just think about the complications of restarting the engines after making each change. He noted that, in flight, small differences in the engines' rpm had no noticeable effect. He also learned—the hard way!—that he needed a greater fuel capacity than is usual for a single-engine plane. More fuel was used when preparing for takeoff, and Ralph had to make sure he had enough for the expected flight time so that a shortage wouldn't cause an engine to cut out.

AND PROPO, TOO...!

At that time, Ralph was involved with the ACL proportional system produced in his area and, naturally, he wanted to use it. The big question was: how could he get the four controls he wanted from his 3-channel system? His answer? He connected the ailerons and rudder for coupled imput. Taxiing maneuvers were included in contest schedules then, so Ralph also installed a nosewheel brake that was activated by a cord that tightened when he applied down-elevator. (Sneaky?)

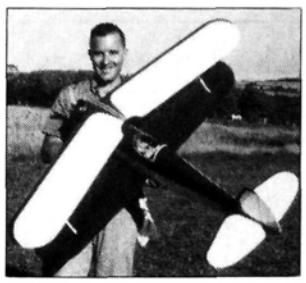
We take so much for granted today that it's amazing to read about the struggles of those early days. As well as being informative, Ralph's article is also an excellent example of how R/Cers pass on their findings and ensure the rapid progress of R/C.

ANOTHER AGS STALWART

Another member of the Aero Guidance Society sent me a fine letter and some interesting photos. Bob Noll and his wife, Lanny, have been club stalwarts since 1954. As a perennial competitor in both pattern and pylon, Bob's flights with his flawless models are always exemplary. He's particularly proud of his National Formula II Pylon record.

His photos show the path followed by many in the AGS. In 1954, Bob's first R/C plane was the Royal Rudder Bug, which he controlled with a ground-based Esco transmitter and an Esco-Lorenze receiver that used a Sigma 4F relay, which drove a Berkley escapement. For power, he chose the widely used K&B .19.

Another photo shows the LW Champion with which he won his first trophy at an Easton, PA, contest—the first of many. Taken in winter, the photo shows how dedicated the members of the AGS were; to join their elite "Around-the-Year Club" you had to fly at least once a month for a year—no mean feat in Endicott's climate!

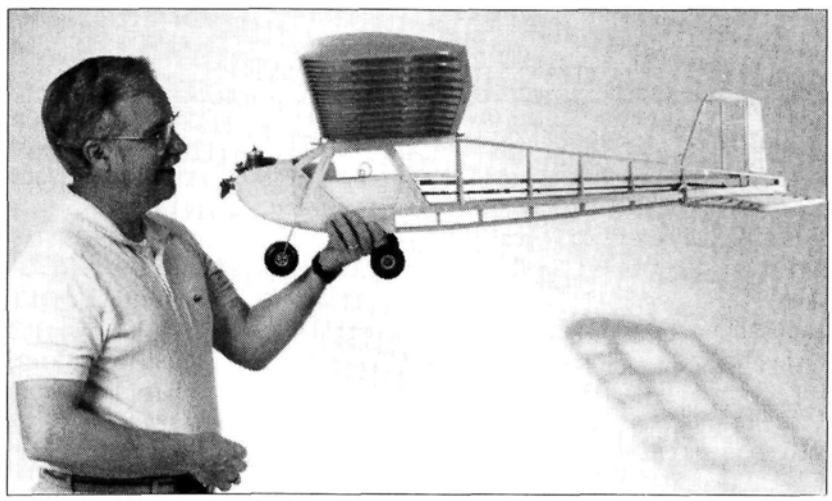


Bob Noll with his Astro Bipe in 1961—remember that one?

Like most of us, Bob did his time in the service. He and Lanny got married while he was still at Ft. Sill. His wedding present? What better than an Orbit System and an Astro Bipe kit? He cut out all the parts while still in the army, and he assembled it after his discharge.

Boys do grow up, and if *you* grew up with R/C, what's your choice of vintage plane? Your first R/C seems a logical choice. Bob has a Rudder Bug replica and plans to use a vintage engine, but he thinks a modern radio would be more serviceable.

The members of the Aero Guidance Society are excellent examples of the dedicated, fine modelers who are our heritage. Let's hear from more clubs like this. ■



Thirty-seven years later, a Rudder Bug replica is about to be flown by a seasoned Bob Noll.

HELI CHALLENGE

(Continued from page 75)

will always produce a very low nose altitude as the helicopter becomes inverted.

Practice your rolls again and again until you can complete a full slow roll with little or no altitude loss, and without any change in heading. When performed correctly, this beautiful maneuver really impresses spectators. Listen to the rotor speed as you roll to be sure that it neither drops too much nor over-speeds. Work on your pitch curves and throttle curves until you can maintain a fairly constant rotor speed throughout the maneuver.

Next month, I'll discuss the loop and roll, and I'll tell you about some new maneuvers. Until then, perfect those rolls!

** Here's the address of the company mentioned in this article:*
JR; distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826. ■

AIRWAVES

(Continued from page 11)

me that such a system would be a major breakthrough, so I'll ask our readers again. I hope the account of your efforts in Europe will inspire an answer. We'll let you and our readers know. TA

MYSTERY TWISTER

I have a problem you might be able to help me with. I've come across three Xerox copies of an old control-line model of a 1932 Knight Twister. I don't know the name of the magazine, but Walt Schroder built the model and wrote the article. Is he any relation to Art Schroeder? I was hoping that he'd be able to tell me where to obtain a set of plans for this unique biplane. It doesn't look too hard to convert to R/C. If

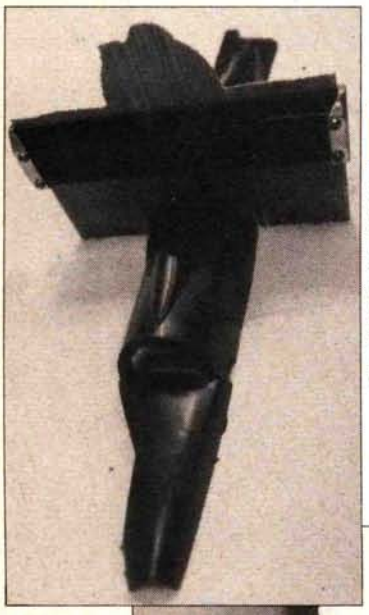
(Continued on page 91)

BUILDING SECRETS

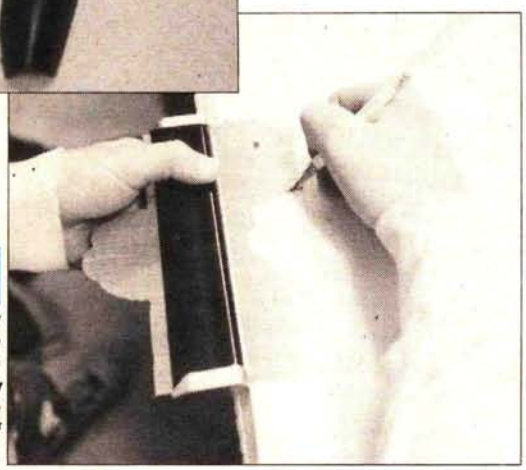
SPECIAL SECTION

Design and construction are key facets of our great hobby. Even diehard fliers of ARFs must repair an injured ship from time to time! And who can resist the occasional temptation to customize a model, build from a plan, or scratch-build a new design? To help you build better models, we want to bring useful building techniques to your attention—whatever your present level of skill. Do you have a building technique you'd like to share with our readers? If you do, we'd like to hear from you.

- *How to scale-up from a three-dimensional miniature*
- *How to build a foam scroll cutter*
- *How—and why—you should lighten sheet-balsa tail feathers*
- *How to make great fiberglass sheeting for covering*
- *How to make strong, light, composite formers*
- *More on how to use carbon fiber*
- *A tip for the electric-flight crowd—How to make an auto fuse arming switch.*



1 *When you press a contour gauge onto an object, its many parallel sliding steel wires copy the object's shape precisely. Press the gauge onto the model, and gently push the ends of its steel wires so that they capture the model's contour accurately.*



2 *Carefully trace the contour onto paper, and try not to disturb the position of the pins.*

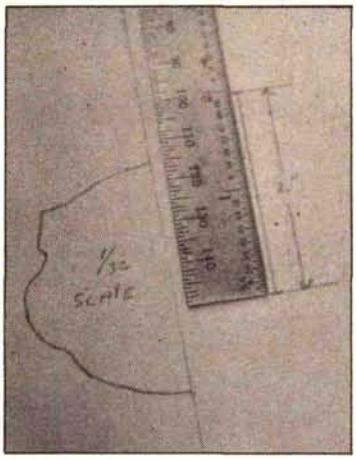
SCALING UP WITH A CONTOUR GAUGE

by RUSS PRIBANIC

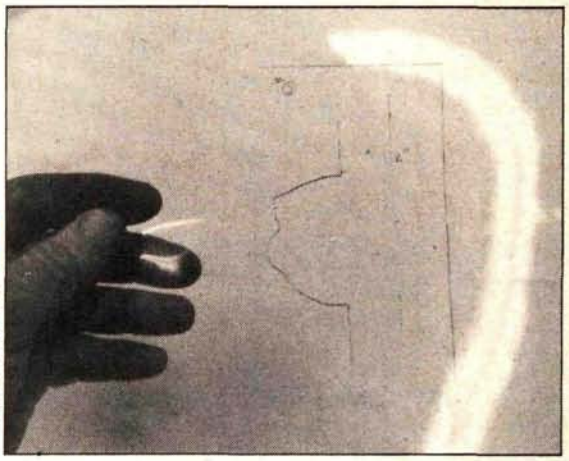
ONE WAY TO build an accurate scale version of an airplane is to use a precisely scaled plastic model. Revell, Inc.* is one of several companies noted for highly accurate scale plastic models. In this article, I'll show how I used Revell's 1/32-scale Harrier Jump Jet kit to scale up to a 1/8-scale, 56-inch-long ducted-fan version with a 48-inch wingspan. Although I also used other documentation (i.e., military color-scheme blueprints), the Revell model provided me with key information about the fuselage's compound curves.

You'll need a carpenter's contour gauge (available at most hardware or lumber stores) and an overhead projector. The photos tell the story.

CONTOUR GAUGE

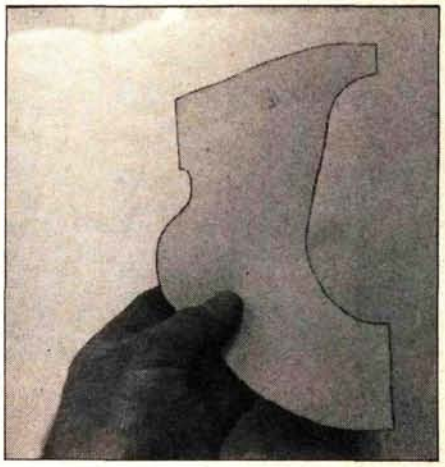


3 *Draw a 2-inch line next to the tracing. (Any length will do as long as it's measured accurately.) When you enlarge the tracing, use this line as a guide to help you capture scale proportions.*

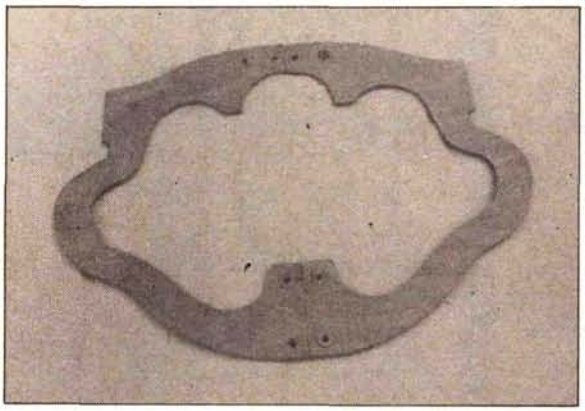


4 *Transfer the tracing to a piece of the clear plastic film that's used on overhead projectors.*

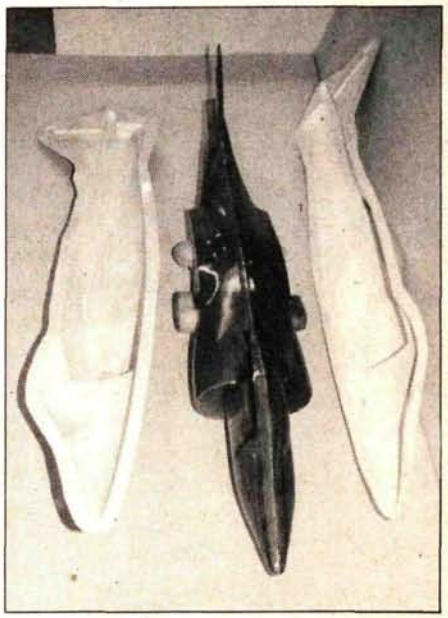
5 *Hang some tracing paper on the wall where you plan to project the image. Adjust the projector so that the image isn't distorted. (One way to do this is to draw a square around the tracing on the plastic film; adjust the projector until the projection of the square is accurate.) Using the line next to the tracing as a guide, enlarge the tracing to the scale you want. (To create a 1/8-scale Harrier, I had to enlarge the 1/32-scale tracing four times, so I enlarged the image until the 2-inch line measured exactly 8 inches.) Again, check that the projection is accurate, and then trace the projected image.*



6 *Here's a sample former template for the 1/8-scale Harrier that I created using this procedure.*



7 *I used this plywood former to make a plug for the Harrier. I made a fuselage mold by laying fiberglass over the finished plug.*



8 *The joined fuselage halves are flanked by the molds.*

9 *Here's the completed fuselage shell made of fiberglass cloth and epoxy.*

**Here's the address of the company that's mentioned in this article:*
***Revell, Inc.**, Dept. FS1, 363 North 3rd St., Des Plaines, IL 60016.*

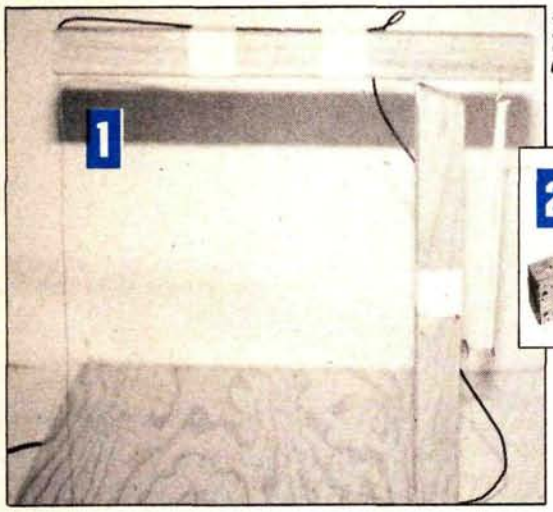
BUILD A FOAM SCROLL CUTTER

by BILL GRIGGS

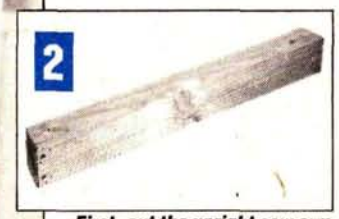
FOAM AND FIBERGLASS fuselages can be made more easily with the help of a simple, inexpensive tool called the "foam scroll cutter" (see photo 1). Many scale three-views show a variety of fuselage cross sections. You can make simple templates of these cross sections out of cardboard and then cut foam blocks to shape using the scroll saw. These blocks can then be stacked, epoxied together, and covered with fiberglass to form a fuselage. You have the option of making the foam fuselage partially hollow by cutting appropriate cores out of the sections, or dissolving the foam out entirely after you've applied fiberglass.

MATERIALS

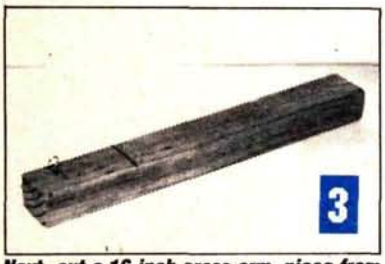
- Homebuilders Hot-wire Kit
- 2 feet of stainless-steel safety wire
- 2x2x32-inch piece of scrap lumber
- 18x30x1/2-inch piece of scrap plywood
- 1 1/2-inch cabinet hinge and fastening screws
- 2 eyelet or wood-screw hooks
- 10-foot length of electric lamp cord
- 2 wood screws and 4 metal washers
- 5 rubber bands



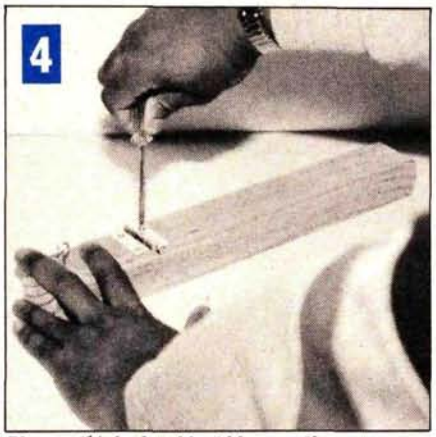
The foam scroll saw is easy to build.



First, cut the upright saw arm out of a 16-inch piece of 2x2-inch lumber. Then cut a 1/2-inch bevel in one end. This bevel allows the cross arm to swing, and it adjusts the tension on the cutting wire.



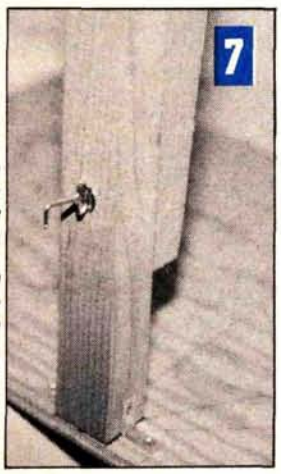
Next, cut a 16-inch cross-arm piece from another 2x2-inch piece of lumber. Draw a line about 4 inches from one end of the cross arm. Screw a hook into the same end, about 1 inch from the end of the piece.



Place a 1 1/2-inch cabinet hinge on the cross arm, centering on the mark you made earlier, and screw it into place.

Take the upright piece you cut in Step 2 and screw the other end of the hinge into place on the longest side of that piece (see beveled end in photo).

Make a base piece from 1/2-inch plywood. I made my base out of a piece of 18x30-inch scrap. Size isn't critical. Secure the upright to the base with angle brackets. The upright should be centered on the rear edge of the base.



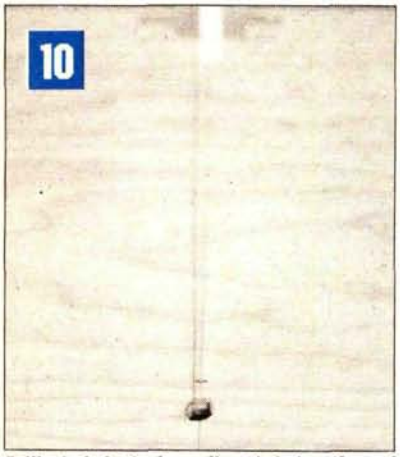
Install a hook on the rear of the upright, about 9 inches from the top.

Strip the insulation off 3/8 inch of one end of a piece of a 10-foot lamp cord (lamp cord is recommended in the instructions with the hot-wire kit) and install Sermos* connectors in accordance with their instructions. Strip one inch off the other end of the lamp cord, and then part the wires for about 2 feet.

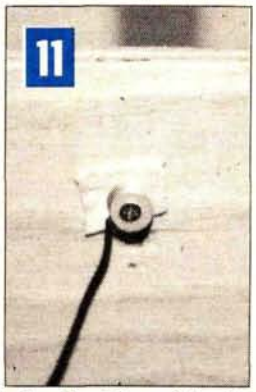
Attach one wire from the lamp cord to the front end of the cross piece. Sandwich the wire between two washers, and wrap it around the wood screw that holds the washers in place. Don't tighten the screw yet. Wrap a piece of .032-inch safety cutting wire or nichrome wire around the screw two or three times, and then tighten the screw.

PHOTOS BY BILL GRIGGS

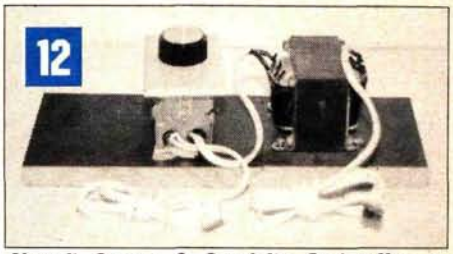
FOAM SCROLL CUTTER



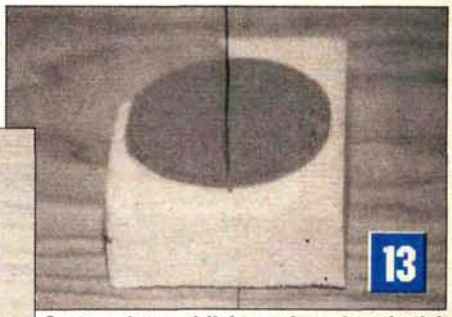
Drill a hole in the base directly below the end of the cross arm (the wire will drop through this hole). Use a carpenter's square to precisely set the alignment. Pass the end of the safety wire through the hole.



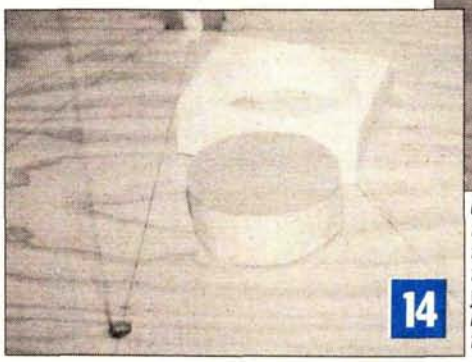
Secure the safety wire to the bottom of the base—again with a wood screw and washers. Also connect the other end of the lamp cord to the screw. Attach approximately five rubber bands to the hooks on the back of the upright and cross arm. Adjust the length of the safety wire until it's taut, then tighten the screw. For neatness, tape the lamp cord to the cross arm and upright.



Aircraft Spruce & Specialty Co.* offers a Homebuilders Hot-wire Kit. It also sells stainless-steel safety wire by the foot or the roll. You can get the kit and all the safety wire you'll need for less than $25.



Cut templates of light card stock and stick them to the foam blocks with double-sided tape. Just hook up the transformer and turn the power up until the foam melts easily, and you're ready to go. When all the formers have been cut, glue them together, and cover the fuselage with light fiberglass cloth.

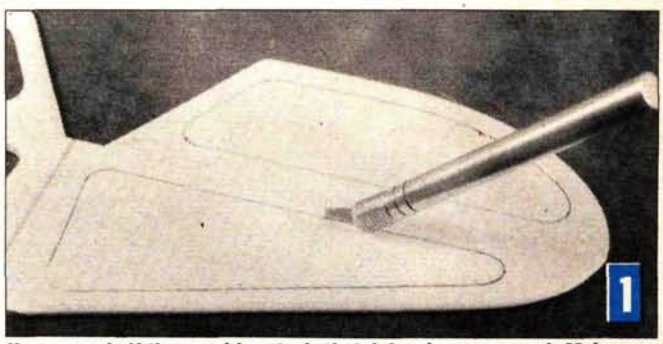


*Here are the addresses of the companies mentioned in this article:
Sermos Snap Connectors, Cedar Corners Stn., P.O. Box 16787, Stamford, CT 06905.
Aircraft Spruce & Specialty Co., Inc., P.O. Box 424, Fullerton, CA 92632.

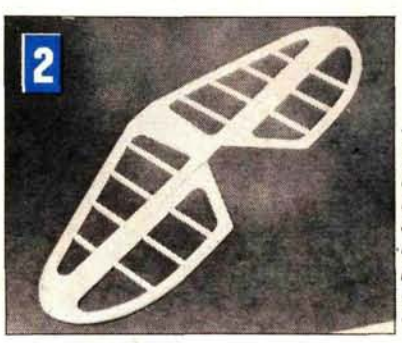
LIGHTER TAIL FEATHERS

by RANDY RANDOLPH

ASK ANY OLD-TIMER how to improve a model airplane's performance, and he'll say, "Add lightness." An oxymoron it is, but it can be done. The primary place to reduce a plane's weight is its tail. Most manufacturers make tail surfaces of solid-sheet balsa, because it's easy, it cuts production costs, and it reduces the kit's retail price. Air is still lighter than wood, however, so the tail surface is a good place to start a weight-reduction program. If you reduce a plane's weight in this area, you can also reduce weight in its nose and keep the balance point in the proper place. An ounce saved in the tail can sometimes enable you to reduce a finished plane's overall weight by 1/2 pound.



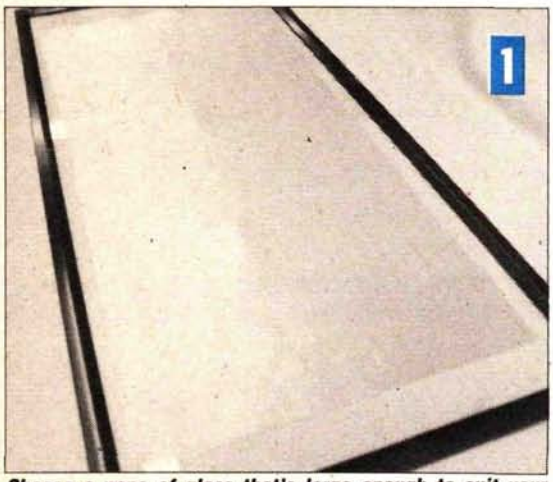
Here, over half the wood in a typical stab has been removed. Make sure that the leading and trailing edges of the stab and the elevator are about three times as wide as they are thick (e.g., if the wood is 1/8 inch thick, the surface should be 3/8 inch wide). The tips should be a little wider because of the wood's cross-grain. Next, notch the leading and trailing edges of both surfaces at the rib locations. As a rule, rib spacing of about half the average chord is usually right. The ribs should be square and of the same thickness as the surface. In some cases, you can strip them from the wood that you removed during the lightening process.



The lightening job isn't difficult, and the result is a surface that's as strong as the original but much lighter. This procedure can also be used on the fin and rudder.

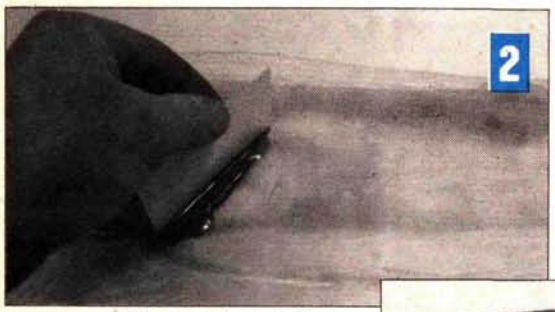
EASY, MULTIPURPOSE FIBERGLASS SHEETING

by RUSS PRIBANIC

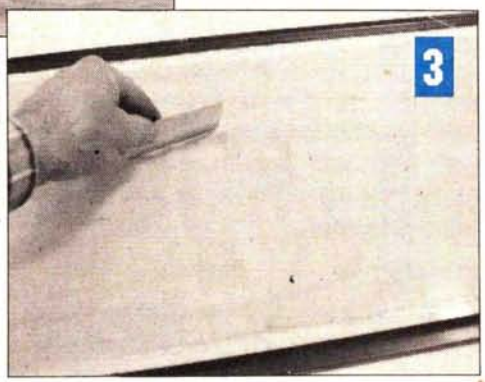


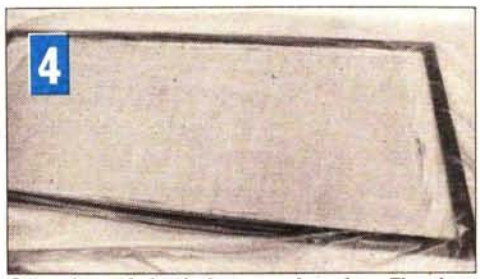
Choose a pane of glass that's large enough to suit your project's needs. Clean the glass, apply mold release (e.g., Partall Mold Release offered by Wicks Aircraft Supply*), and wait 10 minutes for it to dry. Then cut out a piece of 3-ounce glasscloth (it weighs 3 ounces per square yard) that's 1 inch smaller than the perimeter of your glass pane. Lay the cloth on the glass.

LIGHTWEIGHT, DURABLE fiberglass and epoxy sheeting can easily be made to order. On one side, it has a glass-like finish, and on the other, it's textured so it bonds well to your model. This finished sheeting is ideal for covering wings or building structural members such as bulkheads, firewalls, hatches and the like. How light is this sheeting? Obechi wing sheeting that's .023 inches thick, with MonoKote*, weighs .92 ounce/square foot, or .22 ounce/square foot *more* than this much stronger fiberglass sheeting. Using a 3-ounce glasscloth, this sheeting weighs .7 ounce/square foot.



Mix approximately 1/2 ounce of Safe-T-Poxy* (a two-part resin epoxy) for each square foot of glasscloth, and pour the mixture over it. Use a plastic card to squeegee the epoxy evenly over the glasscloth.





Cut a piece of plastic from a garbage bag. The piece should be larger than the pane of glass. Lay the plastic over the epoxy.

Bevel the ends of a 2-inch piece of 1/2-inch wooden dowel so that it won't rip or dig into the plastic.

Working from the center, roll the dowel across the plastic to smooth the epoxy, and push any excess past the edge of the glasscloth and onto the rim of the glass pane.

Leave the plastic on while the epoxy cures in a warm (80 to 90 degrees Fahrenheit) area for 24 hours, then remove the plastic.

FIBERGLASS SHEETING

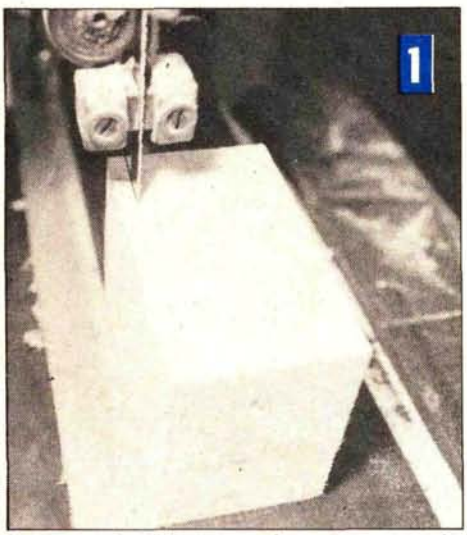
Now peel the glasscloth off the glass pane. Notice the perfectly finished surface of this flexible, light, super-strong sheeting. Its upper surface retains a light texture from the weave of the cloth. It can be cut to any shape and glued (e.g, with spray-on adhesive or CA) or attached (with double-sided tape) to model surfaces, with its textured side facing down. It can also be used to create super-strong bulkhead formers (see my next article).

**Here are the addresses of the companies mentioned in this article:*
***Wicks Aircraft Supply**, 410 Pine St., Highland, IL 62249.*
***Safe-T-Poxy;** manufactured by Wicks Aircraft Supply.*
***MonoKote;** distributed by Great Planes Model Distributors, 1608 Interstate Dr., P.O. Box 4021, Champaign, IL 61824.*

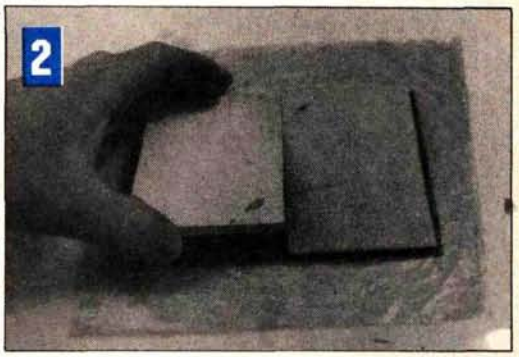
EASY COMPOSITE FORMERS

by RUSS PRIBANIC

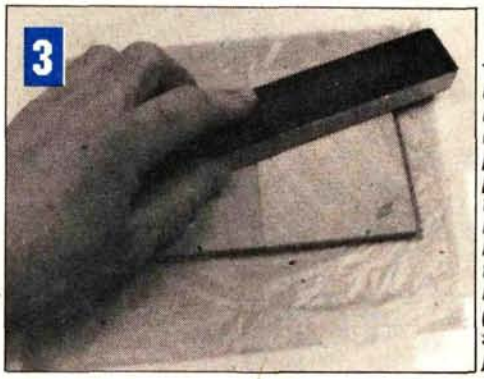
YOU CAN MAKE light, super-strong bulkheads and formers by gluing vertical-grain balsa between two pieces of fiberglass sheeting (see "Multipurpose Fiberglass Sheeting" in this section). Use epoxy to bond the fiberglass to the balsa. You can cut bulkheads or formers out of the composite-laminate blanks that you've made. This composite-laminate material weighs one-third as much as aircraft plywood of the same size and strength.



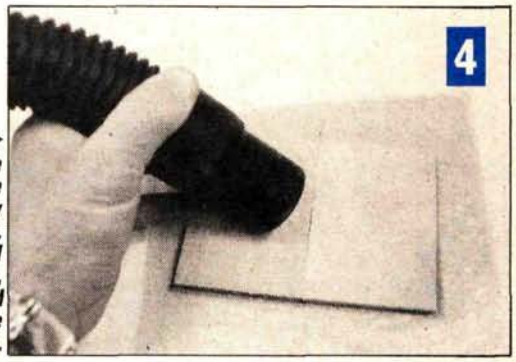
Vertical-grain balsa strengthens the composite bulkheads or formers tremendously in much the same way as the shear webs strengthen a wing. Cut the balsa so that its grain is perpendicular to the fiberglass sheeting.



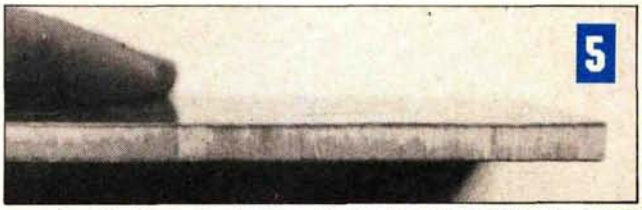
Put a piece of fiberglass sheeting (rough side up) on some plastic, and put the vertical-grain balsa on the fiberglass sheeting. Leave about 1/8 to 1/4 inch of its perimeter uncovered. If one piece isn't big enough, you can use several pieces of balsa to fill out the length or width of the former. Glue the balsa to the sheeting's rough side with the same epoxy that you used to make the fiberglass sheeting (e.g., Safe-T-Poxy).



Use a sanding block or another flat tool to ensure that the balsa pieces are aligned properly, and allow the laminate to cure in a warm room for 24 hours. Then sand the top of the balsa until it's perfectly flat (don't worry about sanding it smooth; just make it true).



Vacuum the balsa's surface to remove any residual sawdust. Lay down the second sheet of fiberglass, rough side up, and epoxy the balsa side of the laminate to it.

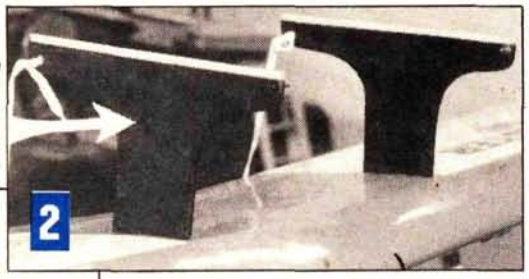


In this edge view of a finished laminate, you can see the balsa's vertical grain. Now you can cut a former or a bulkhead to the shape you need. This composite laminate can be used to build other structural components that have to be strong, yet light (i.e., spars, landing gear or belly-plate mounts, firewalls, hatches, etc.).

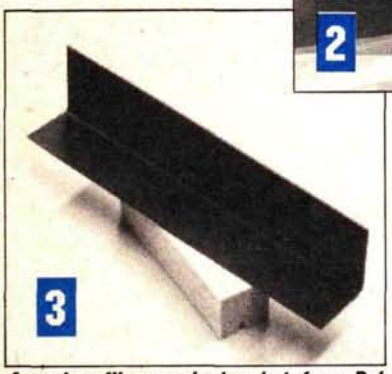
USING CARBON FIBER, PART 2

by GREG POPPEL

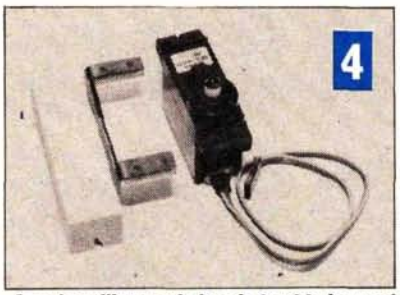
Carbon-fiber mat. See how thin it is?—and it weighs almost nothing.



Glider cradles on a Telemaster .40. Thanks to Jack Conelya for making the test cradles, which work well!



A carbon-fiber angle bracket from Bob Violett Models.



A carbon-fiber angle bracket cut to be used as a servo mount for the servo shown.

IN THIS ARTICLE, I look at two useful carbon-fiber products—mat and angle brackets—which are available from Bob Violett Models* and several other suppliers of composite building materials.

CARBON-FIBER MAT'S MANY USES

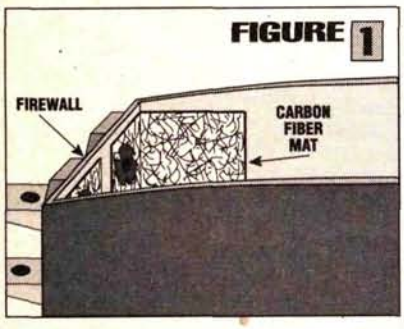
This paper-thin mat is made of many thinly spread, small-diameter strands of carbon fiber, and it can be applied with thin CA, gap-filling CA, or any type of epoxy. Its potential uses are nearly endless: I use it in place of fiberglass to reinforce the firewall on my sport planes (see Figure 1), and I've also seen it used to reinforce wing center sections, where fiberglass cloth might otherwise be used.

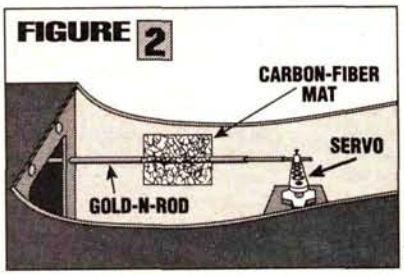
Glider buffs who like the idea of towing their ships aloft might appreciate a cradle made of 1/8-inch medium-weight balsa that's sandwiched between carbon-fiber mat (see photo). The mat was covered with Satellite City's* UFO glue and then pressed with wax paper on each side. The paper allows a very smooth finish, and the completed cradle is stronger than plywood, but only half its weight. The cradle shown was mounted on Hobby Lobby's* Telemaster .40 and used as a carrier for gliders.

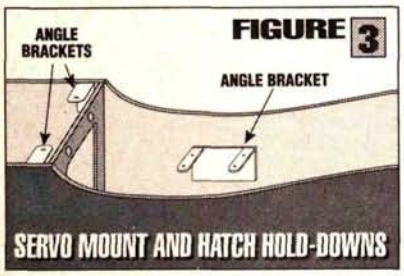
You can also use the mat to support the control rods in your airplane. If you use Sullivan* Golden-N-Rods for your rudder and elevator, you can minimize play in them by using the mat to bind the guide tubes to the fuselage sides. A local jet pilot uses it to support all the control rods in his fiberglass fuselage. He uses Flex Zap* CA and a strip of mat as shown in Figure 2.

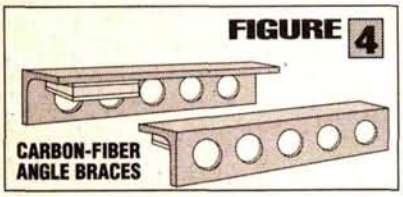
L-ANGLE BRACKET

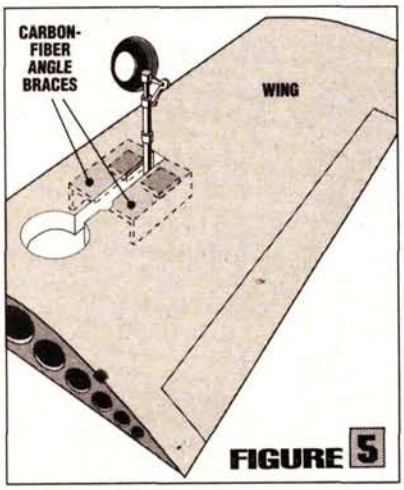
Another useful carbon-fiber product is the angle bracket shown in the photo. I use it as a











USING CARBON FIBER, PART 2

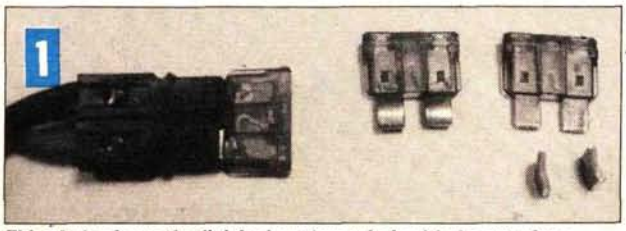
servo mount (see photo). I cut the angle stock to the overall length of the servo, and then I cut out a section of the same size as it. Next, I used thick CA to glue a piece of 1/8-inch plywood to the bottom of the tabs on which the servo is mounted. The plywood supports the servo-mounting screws. To make a good surface for bonding, use 220-grit sandpaper to roughen the side of the angle bracket that will be attached to the fuselage (Figure 3). Now you have a great servo bracket that's strong and light!

Again, following the same principle and using 200-grit sandpaper and 1/8-inch plywood, you can also use angle brackets to make hatch hold-downs (see Figure 3).

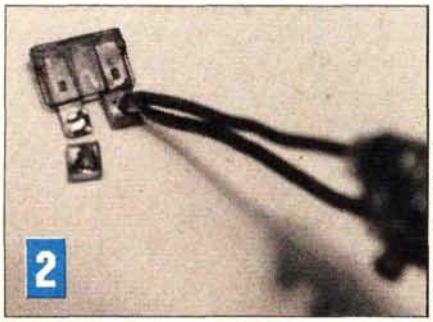
One of the best ways to use the angle bracket is as a brace for retractable landing-gear supports in foam wings (Figure 4). Use your hobby blade to make a slot in the foam that's the depth and the length of one side of the bracket. To ensure that the bracket sits flush with the wing's surface, you'll have to make a slight recess in the foam where the exposed part of the angle bracket will be attached to the bottom of the wing. Trial-fit all parts before you epoxy them. You'll be impressed with the strength of this light, reinforced, retract mount (Figure 5).

I haven't finished yet! Next month, I'll talk about carbon-fiber rods. Remember: fuel 'em, flip 'em and fly 'em. ■

**Here are the addresses of the companies mentioned in this article:*
***Bob Violett Models**, 1373 Citrus Rd., Winter Spring, FL 32708.*
***Satellite City**, P.O. Box 836, Simi, CA 93062.*
***Hobby Lobby International**, 5614 Franklin Pike Cr., Brentwood, TN 37027.*
***Sullivan Products**, 1 North Haven St., Baltimore, MD 21224.*
***Flex Zap;** distributed by Frank Tiano Enterprises, 15300 Estancia Ln. West Palm Beach, FL 33414.*

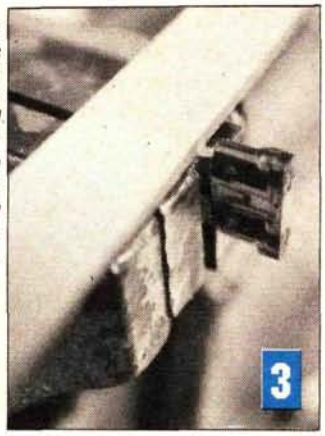


This photo shows the finished arming switch with the auto fuse plugged into a set of Sermos connectors (left); the fuse after it has been modified (middle); and a standard auto fuse with two 1/16-inch-thick pieces of 3/16x1/4-inch brass stock that are used for the modification (right). To create a rounded outer surface on the fuse lugs, crimp these brass pieces slightly lengthwise.



Apply solder to the concave side of each brass piece and to the lug; then position the brass pieces and solder them into place.

After soldering, file the brass pieces until the lug is smooth and fits neatly into the Sermos connector. Although the rounded side "locks" into the connector easily, you can insert this type of fuse so that either the rounded, brass side or the original fuse lug touches the lead in the Sermos connector.



**Here's the address of the company featured in this article:*
***Sermos R/C Snap Connectors,** Cedar Corner Stn., P.O. Box 16787, Stamford, CT 06905.*

ELECTRIC-FLIGHT AUTO-FUSE ARMING SWITCH

by RUSS PRIBANIC

YOU CAN REDUCE your plane's weight, increase safety and minimize electrical resistance by using an arming switch made of an automotive fuse, some 1/16-inch brass stock and Sermos* Power Pole connectors. Always install an arming switch to safeguard against the motor spinning the prop between flights. To minimize power-robbing resistance, keep the wiring harness short. To arm your electric-flight power system, you simply slide the modified fuse into a jack made with Sermos connectors. The photos show how easy it is to make this fuse arming switch, and you can install it wherever you choose—under a hatch or a canopy, or through the outside of the fuselage wall. You can loop a small nylon cord or thread around the modified auto fuse to facilitate removal. ■

(Continued from page 80)

not, then maybe someone on your staff would know. It seems as though anytime I need to know something new about building or flying, you either check a back issue or it runs in a future issue. Thanks very much for any information on this. Also, keep up the excellent work, but after 60 years, I imagine that's pretty much routine!

JIM BOMER
Delta, Ohio

Mr. Bomer, the only C/L version of the Knight Twister I'm aware of appeared in the October '76 issue of MAN and was run with a C/L Hot Canary. Both were profile models, so conversion to R/C is, at best, dubious. Walt Schroder is no relation to Art Schroeder but, coincidentally, Walt was the MAN editor before Art. Unfortunately, Walt Schroder died recently, so the answer to your question may have gone with him. MAN does have the plans to Dan Santich's Knight Twister Imperial (plan no. 1085), which was in the October '85 issue. This is a 1/3-scale design with a 70-inch upper wing calling for at least a 2ci motor. If this is too large for you, and you think you're good enough, the plan can be reduced. CC

MISSING MARAUDER

I'd like to present a friend (a former B-26 crew member) with a model of the Marauder. Unfortunately, I haven't been able to find a kit. Addresses or phone numbers of B-26 kit manufacturers would be helpful. Keep up the excellent work! Thank you.

KARL A. KOZIARZ
Fresno, CA

Karl, the B-26 Marauder is an aircraft of interest to many people, so it's surprising that more kits aren't available. The closest thing is a kit of the A-26 Invader made by Wing Mfg. (306 E. Simmons, Galesburg, IL 61401). We have William Wylam's drawings of the Martin Marauder B-26D (no. WWPO2059), which includes two sheets for $6. (See our December '90 issue for our "Plans Directory.") There's also a plans set for a B-26 with a 65-inch wingspan from Cleveland Model and Supply Co, 10307 South Detroit Ave., Cleveland, OH 44102. Sorry we couldn't be of more help, but maybe there's a kit manufacturer out there with the kit you're looking for. GY

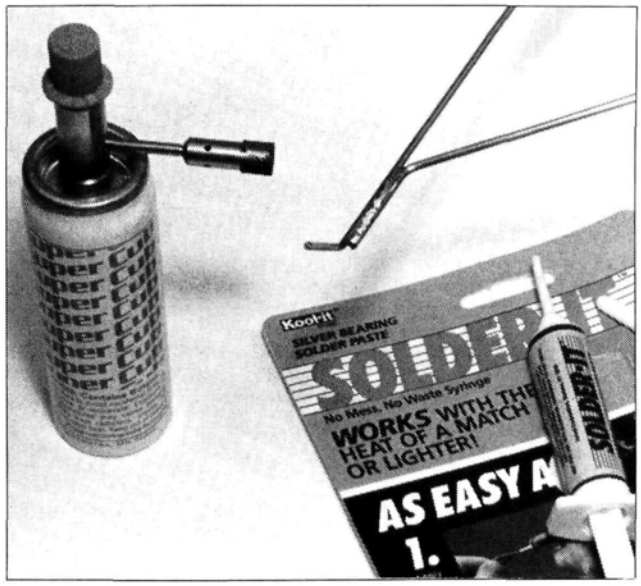
BUILDING
MODEL AIRPLANES

by JOE WAGNER

Products for better building

STEEL WIRE parts for model airplanes often have to be joined. Landing gears, biplane struts, and Y-type pushrods, for example, all require a strong, reliable bond between two or more pieces of wire. The usual method involves wrapping the junction with thin copper wire, then soldering the assembly. I explained the best ways of doing that in an earlier column. This time, I have a newer, stronger and neater process to describe.

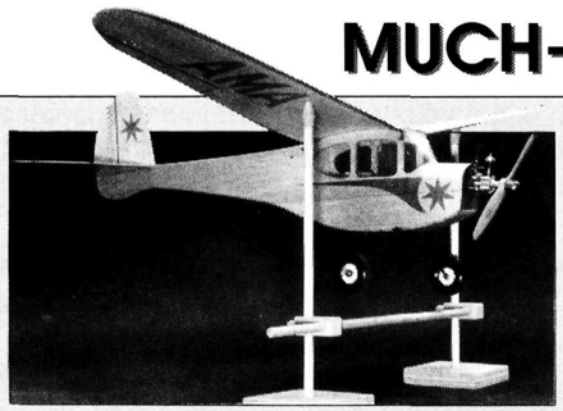
"Solder-It" is a paste of flux and a finely-powdered alloy of silver and tin, packaged in a hypodermic-like plastic dispenser. I've found using it exceptionally easy and neat. You bend the wire parts so they fit accurately together, and then thoroughly clean the wire areas to be joined with medium abrasive paper and a solvent (e.g. lacquer thinner). Then, with temporary clamps or bindings, hold the wires in the precise position in which you want to join them.



Solder-it in use. The wires must be prevented from shifting until the solder has cooled. An external clamping jig (not shown) does the job here.

After that, you just squeeze a string of Solder-It along the juncture, then heat it until it flows into a smooth fillet between the wires. A gun-type soldering iron will work for this, but it's not the best way to go. I prefer to use one of the miniature butane torches now available. Microflame's "Super Cub" does an excellent job of fusing Solder-It. For really intricate joints like 1/2A biplane struts, a pencil-type

MUCH-NEEDED TIME SAVER



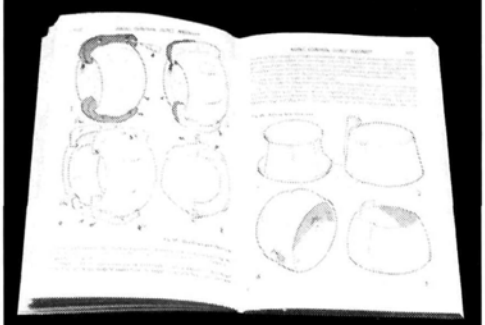
Ace R/C's combination balancing and dihedral stand doing one of its jobs. When setting dihedral, adjusting the crossbar height provides any tip height needed.

Some of the tasks required when building model airplanes can seem awkward if attempted with makeshift methods; but with the right equipment, those tasks can be done quickly and easily. Accurately setting the wing dihedral is one of these jobs. Another is adjusting the balance point (CG) of a completed model. For your R/C airplane to fly the way it was designed to, its dihedral and CG location have to be right.

Ace R/C, Inc.* makes an excellent, yet inexpensive, gadget to accomplish both of these tasks. Called "Dihedral and CG Stand," it's a hardwood assembly that comes in kit form and goes together precisely and quickly. On mine, the only extra work I thought necessary was to round the edges of the wooden components slightly with sandpaper, and to sand the surface fuzz off the dowels.

Ace's instruction sheet clearly illustrates how to use the Stand, so there's no need for me to explain that here. All I can add is that I wish I'd had one of these units a long time ago. It's a genuine time-saver for two vitally important modeling jobs!

BRITISH BOOK BONUS



Almost every topic in Gordon Whitehead's book on R/C scale models is clearly illustrated. These pages on radial cowling are typical.

Though published in Britain more than 10 years ago, Gordon Whitehead's "Radio-Control Scale Aircraft Models for Everyday Flying" is still available in limited quantities from Zenith Aviation Books*. That's good news (courtesy of my old friend Bill Hannan in Magalia, CA), because Whitehead's book effectively shows and describes how to accomplish many tricky model-building tasks. It's one of the best books on this topic that I've ever read.

With exceptionally clear line drawings and a well-written text, this book tells how to make wire-spoke wheels, "P-40-type" retractable landing gear, formed-metal cowlings (fiberglass ones, too), biplane struts, Spitfire-type wing fillets, and just about every other sort of model construction method you're ever likely to need.

Though the book's primary emphasis is scale models, the techniques Whitehead shows and describes are equally useful for *any* kind of R/C airplane. The author is probably the world's most prolific designer, builder, and flier of *practical* (i.e. non-museum type) R/C scale aircraft. All of the recommendations and techniques in his book have been thoroughly tested and proven. Best of all, they're not difficult to understand or execute.

As well as construction methods, "Radio-Control Scale Aircraft Models for Everyday Flying" contains concise, easy-to-understand information on aerodynamics, control-surface effects, and even flight testing and aerobatic maneuvering. This is as close to being a complete one-volume handbook on R/C model airplanes as I've ever seen. It's so good, I wish I'd written it myself!

butane torch is even better.

With Solder-It, you don't need copper-wire overwrapping, because the fused alloy is about five times as strong as 60-40 solder, and it adheres tenaciously to steel (including most stainless alloys). Also, it remains bright and shiny instead of dulling and darkening the way tin-lead solders often do.

There are just two vital points to keep in mind when joining music-wire parts with Solder-It. First, *don't overheat!* Use your little butane torch like an airbrush, and "paint" the heat gradually along the joint area. Excessive heat will destroy the wire's elasticity, and it may cause the solder to deteriorate. Second, after soldering, wash the area around the joint thoroughly with hot water,

No bigger than a marking pen, this mini-torch is perfect for use in tight spaces. Butane lighter fuel provides the heat.

to remove all flux residue, or the wire may rust.

Correction: *In a previous column, I gave a Canadian address for the importer of LiteSpan covering material. The company has moved to the United States, so for more information on LiteSpan, contact Idealair Models, Box 44853, Detroit, MI 48244.*

**Here are the addresses of the companies mentioned in this article:*
Ace R/C, Inc.*, 116 W. 19th St., P.O. Box 511C, Higginsville, MO 64037.*
Zenith Aviation Books*, 729 Prospect Ave., P.O. Box 1, Osceola, WI 54020.* ■

SMALL STEPS

TWIN FANTRAINERS, MINISERVOS AND MORE

by RANDY RANDOLPH

MORE AND MORE fantrainers are showing up all over the country. (See "1/2A Fantrainers" by Paul Willenborg; *MAN*, January,'90.) Almost without exception, their performance with an .049 engine rivals those of the powered, ducted-fan airplanes, which need .90s and 1.20s to stay in the air. LTV, in conjunction with Fairchild and others, organized a study that resulted in an R/C model of a twin fantrainer. The full-scale airplane was never built, but project test reports predicted a high-performance airplane. I wonder who will come up with the first twin-fan airplane using two .49s?

The use of muffler pressure ("Muffler Pressure for the .049," Randy Randolph, *MAN*, May,'90) for the Cox .049 engines makes such a big improvement to fuel flow that rpm remains constant throughout each run. (Something to remember when that next twin-engine project comes along.)

While still on the subject of the fantrainer, the lack of availability of three-blade pusher props for engines other than the .049 has been something of a hindrance to the development of airplanes using power sources larger than the .049. Fantrainers powered by .10, .15 or .20 engines would have better throttle control and, using super-miniservos, perhaps retracts as well.

If it wasn't for the popularity of 35mm cameras, there might not be any miniservos.

CAMERA CONTRIBUTION

When you finish that new super-twin and snap its picture, remember that the development of automatic shutters and focusing devices for cameras brought about the mass production of very small coreless motors. These motors are the driving power in all automatic cameras. They respond rapidly to the changing voltage because there's so little mass in the armature (the revolving part of the motor). This makes them ideal for servos as well as cameras.

Those of us who have been building smaller airplanes for a long time are very familiar with sub-miniservos like the Futaba S33 in the picture, but newcomers to the ranks may not be as well-informed. These servos weigh less than three first-class letters, but they have almost as much muscle as their bigger brothers. So, thank all the shutterbugs around the world for these little beauties.

It looks like doped tissue, but it isn't.

LITE(SPAN) 'N' LIVELY

Weight has always been a problem for all types of aircraft, from the first hot-air balloon to today's space shuttles. The old saw that, "given enough power, a brick can be made to fly; but the lighter the brick, the better it flies" certainly applies to models. Litespan covering material comes from Solarfilm in England, and it may be an answer to the weight problem. Though it doesn't magically lighten your plane, it doesn't increase weight as much as some other materials.

Litespan is a synthetic film that looks like well-doped Japanese tissue but, unlike doped tissue, it doesn't feel crisp. In Europe, modelers use it to cover rubber-powered, "peanut-scale" airplanes, so you know it's light. Like Micafilm, Litespan requires that a heat-actuated adhesive like Balsarite be applied to the structure and allowed to dry before it's ironed over the structure's surface. Heat will tighten the material once it's in place. Litespan shrinks less than with any other film, and this reduces the warping of light structures. It's also waterproof and resists glow fuels. Charlie's R/C Goodies*, which makes the famous Cannon radios, is the U.S. importer of Litespan. It's available in most popular colors.

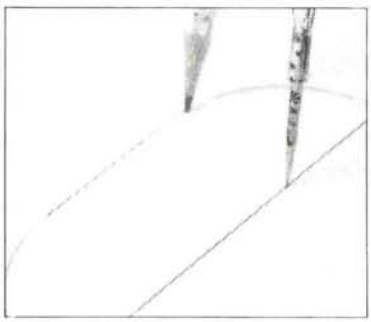
A letter from Derek Woodward, SMALL's British correspondent, provided

this information and the samples shown. It's a wonderful thing to have friends in the know.

FAB FORMERS

A while back in one of my "How-To" columns, I showed a system for drawing cheap elliptical bulkheads for fuselage turtle decks. There's no question that an ellipse is the best way to go, but it's the most difficult to construct, even using the easy method. An even less expensive way of adding a little class to an otherwise square fuselage is the system shown in my last photograph.

Simply measure the height and width needed at each station; then strike a couple of arcs with radiuses equal to the measured



Bulkheads the easy way, (see text).

height, and space them the proper distance apart to meet the width requirement.

Now, join the tops of the arcs with a straight line. The resulting formers work well with sheet covering or stringers. You'd be surprised at the number of full-scale airplanes built using this method.

**Here are the addresses of the companies mentioned in this article:*
***Charlies R/C Goodies**, 13400-30 Saticoy St., N. Hollywood, CA 91605.*
***Futaba Corporation of America**, 4 Studebaker St., Irvine, CA 92718.* ■

HELICOPTER SECTION

John Bona's scale Schluter Twin Star takes to the skies—very full-scale appearance and performance.

This section contains articles of interest to heli fliers and those who want to learn more about helis. Craig Hath reviews the Kalt Enforcer—a 30-size helicopter with the "feel" of a larger machine—which is predictable in hover for beginners, but also great for pilots who want to try aerobatics. John Bona reviews the Schluter Twin Star (it sports a triple-blade rotor head), and he shows how realistic one of these helis can look when given a fine, scale dress. In "Helicopter Challenge," Craig Hath continues his critical discussion of aerobatic maneuvers; this time, how to roll your helicopter. Paul Tradelius moves on from his discussion of chordwise CG in the January issue to cover the mechanics of moving it to obtain a more forgiving performance. Finally, see "Rotary-Wing Roundup" for a peek at some of the newest products displayed at recent trade shows.

KALT Enforcer

Sport heli for sport or aerobatics

Far left: Craig Hath starts the Enforcer with the new starting system from Vortex R/C Helicopter. (Note the attached starter battery pack—no wire leads to get in the way.)

by CRAIG HATH

THE .30-SIZE HELICOPTER revolution started more than 10 years ago with the introduction of the Schluter Heli-Baby (actually, a .25-size machine), which was quickly followed by John Gorham's Cricket. Both of these fixed-pitch helicopters were designed for entry-level fliers who wanted to investigate this new aspect of the hobby, but who didn't want to invest a lot of cash in equipment. In addition, the simple mechanics of these machines enabled just about anyone to build them successfully.

Now, .30-size machines are easy to build, maintain and—best of all—fly. Some of them even come almost ready to fly (ARF)—a trend that was launched by the Hirobo Shuttle. The Kalt* Enforcer is the newest entry into this group of machines. (Kalt is a Japanese company that was one of the first to manufacture R/C helicopter kits.) This "second-generation" .30-size helicopter was preceded by Kalt's Baron .20, .28 and 30MX. Although these kits are manufactured by the same company and use .28 to .35ci engines, that's where their similarities end.

The Enforcer is a completely new design, and it was developed by former World Champion Shigetada Taya—the father of the popular Kyosho Concept .30. It's an all-out sport flier with full aerobatic capabilities, yet its docile flight mannerisms make it a good trainer, too. Its features include a sealed main-drive transmission with a unique planetary-gear system; Bell-Hiller mixing; autorotation; top-cone starting; modular construction; and, except for main rotor blades, you don't have to glue or paint any of its parts when you assemble it. Ball bearings are used throughout the Enforcer, and thi s eliminates the need for costly upgrades and makes this helicopter a good value.

There are two versions of the Enforcer kit: assembled and ARF. I'll review the ARF kit so that you can take advantage of some assembly tips.

KALT Enforcer

CONSTRUCTION

The manual has instructions for both versions of the kit, but they need some polishing—especially the written assembly sequences. Although the line drawings are clear, certain steps need clarification, and some of them have even been omitted. This is my second Enforcer (Steve Stuart, Tom Dooley and I built the first one in a motel room in Champaign, IL, during last summer's Kyosho Challenge), and I still have memories of disassembling parts and re-doing steps—work that could have been avoided if some of the instructions had been more precise. (See the section with the revisions to the manual.)

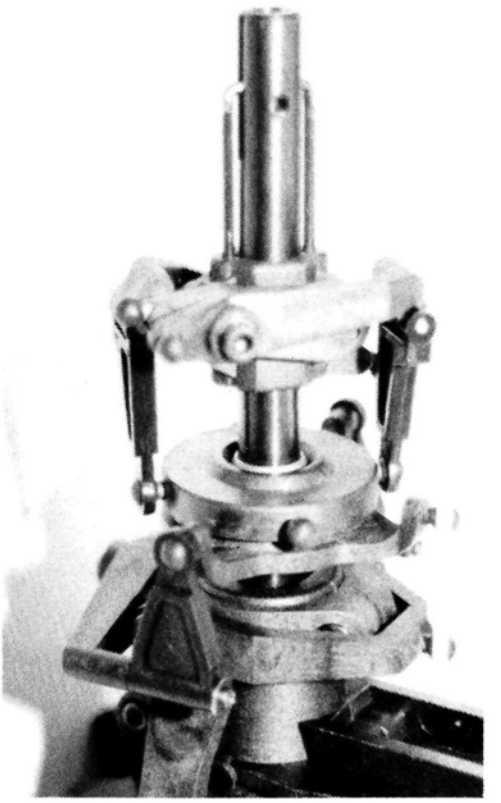
Here's the kit box and its contents.

Despite the problems with the instructions, the Enforcer is fun to build, and every piece fits perfectly. The only areas that have to be trimmed are the canopy, the cooling shroud (for engine clearance) and two places on the main frame (to provide clearance for engine accessories). Kalt has separated all the small parts and hardware into numbered bags that correspond with numbered assembly steps. This enables you to build the Enforcer in phases and makes it easy to find everything.

I painted the body and the tail pieces, but I'm not sure how well the paint will hold up. The body seems to be made of a soft plastic with a high silicone content. It's extremely durable, but paint doesn't adhere to it very well. On the other hand, the kit's decals give the Enforcer a very nice finished look, and they're quite durable when applied to an unpainted body.

PRE-FLIGHT SETUP

The manual clearly explains all the control hook-ups and the correct directions of movement. This is critical for first-time builders, and helpful



In this close-up of the unique Bell-Hiller mixing and the swashplate control, notice the dual-pitch rods. Collective pitch is controlled by a single rod that runs through the main shaft's center.

SPECIFICATIONS

Type: *Pod-and-boom helicopter*
Length: *41.34 inches*
Rotor Diameter: *46.46 inches*
Weight: *5.5 pounds*
Power Req'd: *.28 to .35 2-stroke engine*
No. of Channels Req'd: *five (throttle, roll, pitch, tail rotor and collective)*
Sug. Retail Price: *kit—$399; ARF—$429.*

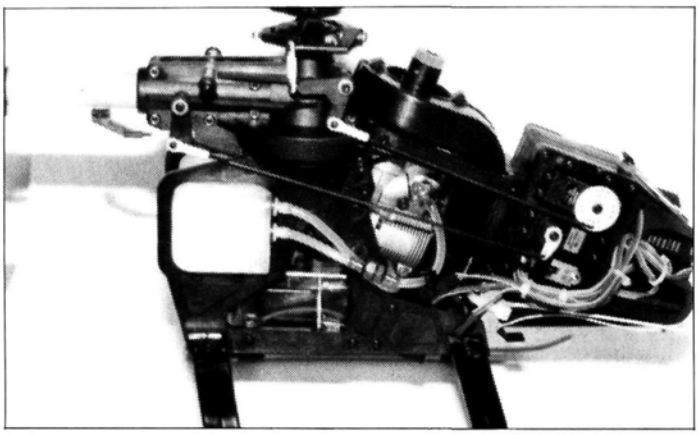
Features: *autorotation, sealed transmission, top-cone starting and modular design.*
Comments: *the fully aerobatic Kalt Enforcer is very stable in hover, and it has the "feel" of a larger model. The settings that work well for hover also provide good aerobatics. Its only weakness is that, with the stock rotor blades, it's sensitive during autorotations. Heavier blades would help retain the rotor disk's inertial effect.*

KALT Enforcer

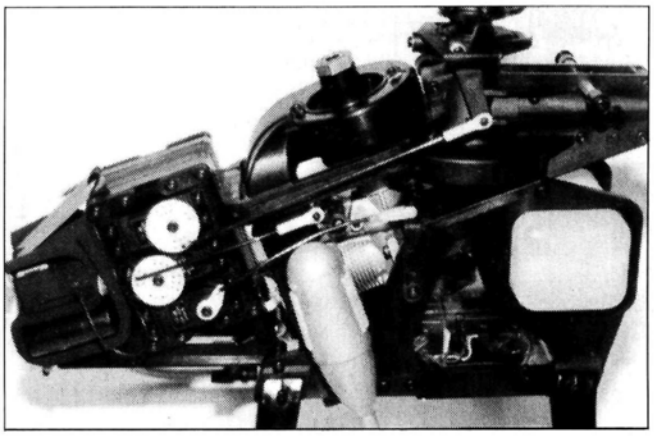
for experienced fliers, too. I really liked the control-by-control adjustment procedure in the manual's "Pre-Flight Adjustments" section. I did, however, have problems with the main-rotor pitch figures that were given.

For optimum performance, the manual suggests a setting of zero at low stick, 7 degrees at hover and 10 degrees at full throttle. Well, my Enforcer works best with 5 degrees at hover and 7 degrees for top-end pitch. I have to set up for autorotations and switchless inverted flight, so I use 3 degrees of negative pitch at low stick with the throttle-hold switch active; 2 degrees of negative pitch at low stick in the normal flight mode; and 7 degrees of negative pitch at low stick in flight mode no. 2. I also use 11 degrees of pitch at full stick with the throttle-hold switch activated. This setup provides well-rounded flight characteristics. (Note: if you're a beginner, keep the low-stick pitch at zero to prevent drastic descents if you chop the throttle in a panic.)

I tried the recommended setup with my first Enforcer, but the main rotors' pitch overloaded the engine. The result?—a flame-out during the inverted part of a roll…crash! (A side note: the Enforcer hit the ground at a sharp angle from over 20 feet up, and I repaired it in less than 2 hours without having to replace a single part—this is one tough bird!)



This close-up shows the right-hand radio and linkage installations.



Here are the radio installation and linkage hook-ups on the left side.

FLYING

Whether you're looking for a solid trainer or a hot performer that will give you a lot of bang for your buck, the Enforcer will fulfill

THE JR® X-347

The multiple pitch curves mentioned earlier in this article should have given some idea of the JR X-347 radio's capabilities. It gives you more flexibility than any radio I've ever worked with. The numbers stand for different features: there are *three* system modes from which to choose—airplane, helicopter, or glider; the radio's memory can store *four* setups for each mode; and this radio is a full *7-channel* system regardless of the flight mode.

In the helicopter mode, the X-347 offers five pitch curves (normal, flight no. 1, flight no. 2, inverted flight and throttle hold), four throttle curves (normal, flight no. 1, flight no. 2 and inverted flight), anti-torque tail mixers for normal and stunt modes, one programmable mix and lots more. Where has this radio been all these years?!

your needs. In hover, this helicopter feels very predictable, and though I hate to use the word "stable" when referring to a heli's flight characteristics, I'm comfortable using it to describe the Enforcer's hovering. Usually, the smaller the helicopter, the more unpredictable its flight mannerisms, but Mr. Taya has found a way to make this .30-size machine seem "larger."

The Enforcer is also completely aerobatic using the same setup that provides good hovering, so you won't have to make many compromises to get the most out of this machine. I did, however, discover one weakness—the Enforcer is very sensitive during autorotations, especially with the stock rotor blades. I've been using Vortex R/C Helicopters'* Phoenix main-rotor blades. They're made of a "multi-wood" laminate, and they have a carbon-fiber main spar and 20 grams of lead in each tip. (The stock blades use only 6 grams of lead, which does little to increase the rotor disk's inertial effect.) Although I managed to execute some successful autos with the stock blades, there were several unsuccessful ones, too. The Phoenix blades have helped tremendously.

GOODIES AND MODIFICATIONS

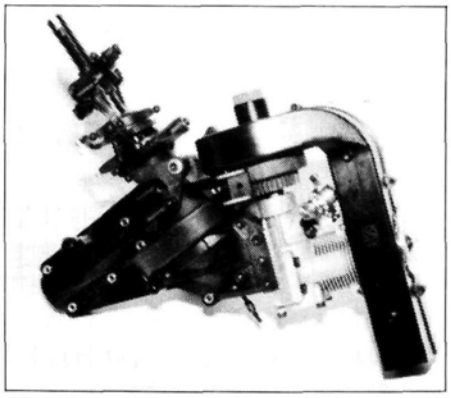
Although you won't need to change much on the Enforcer, there are a few things you might want to modify. The Enforcer's plastic cooling fan houses the aluminum clutch hub. The top of the fan tends to be out of round, and the effect of this is amplified by the starting cone at the top of the fan. Vortex R/C Helicopters offers a system that eliminates the fan run-out and the starting cone. This avoids the vibration that's caused by the stock components.

The landing gear is mounted using M3x18 tapping screws that tend to loosen during hard landings. You might want to replace them with M3x18 cap screws. Also, the main drive gears have a tendency to slip. I think this is caused by excessive end play in the planetary system, and you can control it by following the tips in the construction notes.

THE WEBRA .32

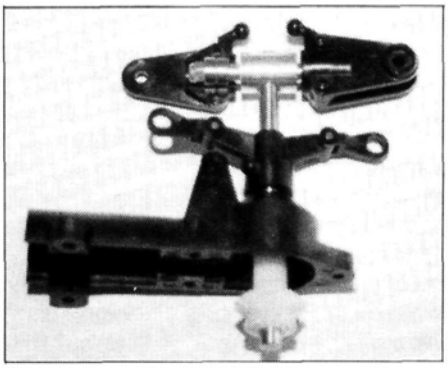
This is Webra's* newest .30-size helicopter engine. It has ABCD construction (i.e., an *aluminum* piston, a *brass* sleeve that's *chrome* plated and a *Dykes* piston ring), Schnuerle porting and dual ball bearings. The Webra .32 has enough muscle to make the Enforcer do just about anything, yet it runs very smoothly during hover and makes the transitions to full power cleanly. Adjusting the engine is simple, and I haven't had any problems with it to date. (Note: I've also been using JR's* X-347 radio—see the sidebar.)

Overall, the Enforcer's performance is outstanding, and it will satisfy the needs of any flier. Try one and enjoy!

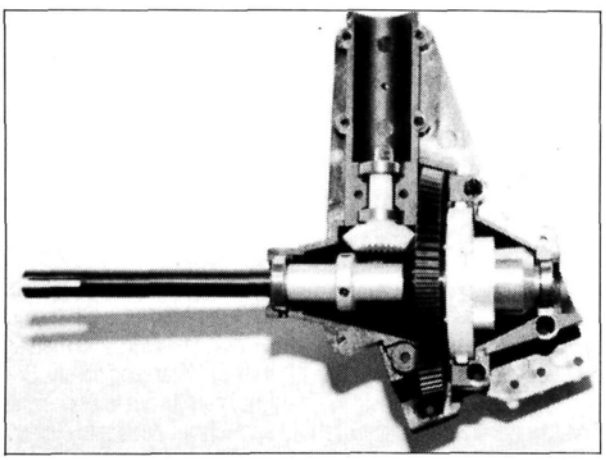


The drive system and engine combined are part of the Enforcer's modular construction concept.

The new Webra .32 has plenty of power, and it makes the Enforcer a pure performer.



Here are the basics of the tail-rotor assembly.

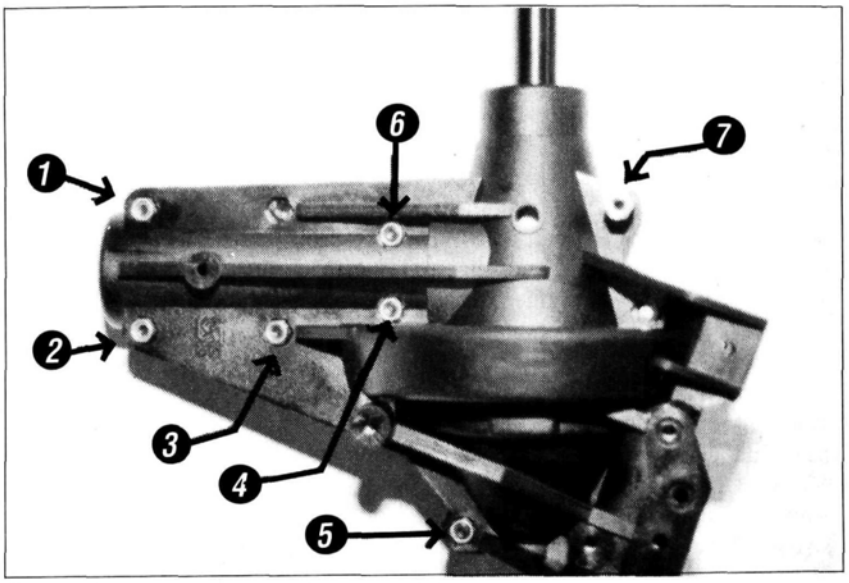


Here are the inner workings of the planetary-drive system, which makes the mechanical drive work very smoothly.

**Here are the addresses of the companies mentioned in this article:*
Kalt; *distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
Vortex R/C Helicopters, *1374 Logan Ave., Costa Mesa, CA 92626.*
Webra; *distributed by Hobby Dynamics Distributors.*
JR Remote Control; *disbributed by Hobby Dynamics Distributors.*

Read on for suggested revisions to the Kalt Enforcer's instruction manual.

Enforcer Assembly Manual Revisions



Here are the correct locations for the seven M3X20 cap screws, the six M3 nylon nuts and the aileron-lever nut. Leave the three nuts in the rear loose until you've installed the boom.

CONSTRUCTION NOTES

IF YOU AMEND your manual with these notes, it will be easier to assemble the Enforcer. All the notes are in the proper order, and their numbers correspond to steps in the manual. In a few places, I've added steps that were omitted. Simply follow the manual and the notes simultaneously as you build. A copy of these notes has been sent to Hobby Dynamics, and I hope they'll be incorporated into future printings of the manual.

The first section addresses the assembled kit. To begin construction, read the manual's introduction, study the parts list (pages 4 to 6) and then skip to page 17 (step 2-1). Most of the parts are packed in plastic bags (inside a large, white parts box), which have numbers that correspond with assembly steps. There's also a matching numbered bag containing nuts, bolts and other small pieces of hardware that's packed separately inside a larger plastic bag full of hardware.

2-1 Assembling the main frame (page 17)

1. Be sure to use the small brass bushings that slide onto each side of the pitch arm (see drawing).
6. Don't over-tighten the setscrews in each landing-gear brace; they strip out easily.

2-2.1 Assembling the transmission (page 18)

2. Put the planetary gears on the pins with the bearings facing up, and don't forget to put the plate washers under the E-rings.
3. It doesn't matter which way you install the shaft stopper. The L-bearing is the large bearing in the parts bag. Although you should leave the setscrews loose, be sure to use thread-locking compound on them now.

2-2.2

1. When the drive-gear/mainshaft assembly has been installed in transmission case "R," press the main shaft down so that it rests on the bottom bearing. Now push down on the shaft stopper lightly to eliminate most of the end play in the planetary-carrier assembly. Tighten the four setscrews in the shaft stopper. It's important to remove all but a very little end play to prevent the drive gears from stripping.
4. You'll find the 3mm brass nuts (they're black) in hardware bag 2-2. *Don't* get glue on the threads of the nuts; use a toothpick to dab the glue into the nut cavities.
5. Refer to the photo with this sidebar for the correct locations of the seven M3x20 cap screws and the six M3 nylon nuts. Leave the three bolts toward the rear loose until the tail boom has been installed. Install the upper front screw in the 13mm aileron lever nut shown in the drawing on page 19. Be sure to use thread-locking compound on the aileron-lever nut.
7. Leave the 30mm body loose until the tail boom has been installed.
9. The aileron-lever nut is installed in step 5.

2-3 Assembling the control section (page 20)

1. The mixing base has a top and a bottom. The joint rods slide into the mixing base part way, and they have to be threaded the rest of the way when inserted from the top. Slide the pitch rod over the first joint rod before you install the second joint rod. Then center the pitch rod over both joint rods.
2. To assemble the mixing unit, you have to attach the mixing lever to it. Slide a M3x4, 5x10 washer followed by a ball bearing onto the M3x12 cap screw. Push this assembly into the front of the mixing unit until the bearing is fully seated. Slide one of the small spacers, another ball bearing and another washer over the threads of the screw on the other side of the mixing unit. Thread the screw into the face of the mixing lever, and tighten it until both bearings are fully seated. Loosen the cap screw slightly until the unit moves freely.
3. File off the nubs on the heads of the two M3x15 hex screws to prevent them from dragging on the mixing lever.
5. The manual should read: slide the lever bracket over the top of the transmission case. Start the M3x12 tapping screw into the rear of the bracket, but don't tighten it. Fit the elevator lever over the lever bracket as shown in the drawing on page 20. Insert one lever bushing "A" into each side of the elevator lever, and install an M3x10 tapping screw with an M3 flat washer through the lever and into the lever bracket on each side. Be careful not to over-tighten the tapping screws.

New Step 6. Put an M3 flat washer over an M3x20 tapping screw (the drawing on page 20 incorrectly shows an M3x10 tapping screw). Put lever bushing "B" over the tapping screw, and slide this assembly into the front of the aileron arm. Put another M3 flat washer on the inside of the arm over the tapping screw, and fasten the entire assembly to the front of the lever bracket. Be sure that the ball joint is on the right side.

New Step 7. Align the elevator lever's rear ball so that it's centered exactly over the seam in the transmission case. Be sure that the lever bracket is fully seated on the transmission, and then tighten its M3x12 tapping screw. Be especially careful not to over-tighten this screw because the lever bracket could break if you do. You might want to replace this tapping

screw with an M3x12 cap screw to prevent the lever bracket from coming loose in the future.

New Step 8. Slide the swashplate onto the main shaft, and push it all the way down to the lever bracket. Snap the two universal-link "Ds" onto the ball arms that extend from the swashplate. Snap the double-link "S" onto the swashplate's rear balls and the elevator lever. All the universal ball links have insides and outsides. If you look closely, you'll see that the diameter of the hole in each link is slightly larger on one side. This is the inside, and it should be installed facing the ball to avoid binding.

New Step 9. Feed the pitch rod through the center of the main shaft, and drop the assembled mixing unit over the shaft until the joint rods fall into the slots at the top of it. Check that the assembly moves up and down on the shaft freely. If there's any binding, fix it now. Snap the mixing-unit arms onto an inner swashplate ball.

2-4.1 Installing the engine (page 21)

Before you start this sequence, break-in your engine on a test stand according to the manufacturer's instructions.

1. There's a clutch spacer for use with Webra .28 or .32 engines packed separately in the kit. The "shouldered" part of the spacer faces downward and replaces the engine drive washer.
4. Be sure that the direction of the clutch shoes is correct.
5. I used Vortex R/C Helicopters' starting systems, and it helps to reduce the run-out of the poorly molded cooling fan. This system eliminates the starting cone; skip to step 6.
7. You might have to drill out the throttle arm to accept the 2mm screw. With Webra engines, you'll also have to bend the throttle arm out slightly to allow enough clearance around the main frames.

2-4.2

1. See the photo that shows how the cooling shroud was trimmed to clear the taller head of the Webra .32. Other engines will have to be trimmed in other places.

2-7 Assembling the main frames and the transmission (page 24)

1. Use eight M3x25 tapping screws on the upper sides of the servo-set bases, and use eight M3x22 screws on the lower sides.
2. Be sure to use thread-locking compound on the four M3x15 cap screws.
3. The last sentence should read: Install a servo-frame stay to each side using two M3x25 tapping screws and two M3x8 cap screws (with thread-locking compound) as shown in the drawing on page 24.
4. If you're using the Webra .32, cut a notch in the main frame to allow clearance for the fuel-pressure nipple and the line on the muffler.

2-8 Assembling the tail section (pages 25 & 26)

8. To get the proper gear mesh, press the inner bearing firmly against the shoulder of the tail input gear. You'll detect a definite snap as the bearing moves into place.
10. In the bag with the black foam for radio installation and the double-sided tape, etc., you'll find a black PP rod retainer that you should slide over the tail-boom's front until it's approximately 12 to 13cm from the front of the boom.
15 & 16. These steps are out of sequence, so you should reverse them. Now you'll install the M3x20 cap bolt before you snap the PP rod into place.
15. To prevent the linkage from binding, be sure that the Z-bend in the tail-pitch rod goes down through the top of the tail-pitch lever. Check that the linkage moves freely, and correct any binding before you proceed.

2-9.1 Assembling the main-rotor head (page 27)

2. Apply some light grease to the main-rotor grip bearings.

2-9.3 (page 28)

3. When you've laid the flybar/seesaw assembly into main-rotor hub "A," put the hub on a flat surface and check that the paddles hang level with it. If not, trim a little plastic off the tip of the heavy paddle until the unit balances.

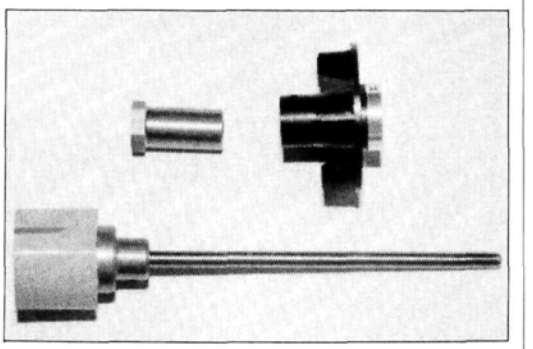
2-9.4 (page 28)

Be sure to align the flybar paddles accurately until they're parallel.

New Step 3. Balance the completed rotor-head assembly on a High Point Balancer. At this point, move to step 1-2.2 on page 8 for final assembly, *not* step 1.2.1 on page 7 as the manual indicates.

1-3.1 Installing the radio system—servos (page 8)

1. An electric screwdriver comes in handy here. I prefer to move the right-hand servos up one space so that I can use the bottom slot for the switch harness and the servo-lead exit. This keeps the installation neat and makes it easier to access the switch.



Vortex R/C Helicopters' Enforcer starting system makes engine starting easier. The fan insert also helps to align the cooling fan, which reduces engine vibration.

1-4.1 Linkages (page 10)

3. Find the position on the servo wheel that's approximately 10 to 11mm from the center of the servo-output shaft and at an 90-degree angle to the servo's center in the neutral position (shown in the drawings). Drill the holes in the servo wheels with a 2.3mm or 5/64-inch drill bit. Anything larger than this will cause slop.

1-5 Assembling the main-rotor blades (page 13)

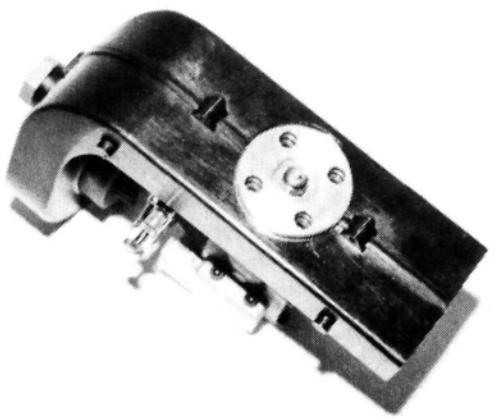
If you have a scale that will enable you to weigh the blades to within 1/10 gram, it's a good idea to check the blade weight as you go. Try to keep the weight of the two blades as close to equal as possible.

1-6.2 Installing the Rotor Head (page 14)

I balanced the rotor head with a High Point Balancer. This method is extremely accurate.

1-7 Assembling the body (page 16)

1. Skip this step—the holes are now factory drilled.
3. Use an X-Acto knife and scissors to trim the plastic canopy. ■



You have to trim the cooling shroud to make it fit most engines. For the Webra .32, you trim around the cylinder head as shown.

PHOTOS BY JOHN BONA

SCHLUTER

TWIN STAR

Scale helicopter project makes news

by JOHN BONA

SCALE MODELS have always fascinated me, but I really didn't realize the work they involved until I decided to build one myself—the Schluter* Twin Star AS355. The .60-size Twin Star has a 55-inch main rotor span, and I modeled mine after the full-size KYW-TV3 helicopter, which operates out of Philadelphia, PA. (The full-size machines are manufactured by Aerospatiale of France.)

I decided to build this model because it's different; it isn't a very popular scale project; and it has a three-blade rotor head.

Compare the bare heli body with the completed project, and you'll see the dramatic impact scale realism brings to this model.

After deciding on the subject, I had to decide on a color scheme, and while looking through magazines, I came across a picture of this unusual, colorful scheme on a KYW-TV heli. With only the photo caption to work with, I contacted News Operation Manager Ellen Hyker, who sent me the photos and information I needed.

I assembled the Schluter kit according to the instructions, but I modified the swashplate and the tail-rotor gearbox mounting. The kit's Champion mechanics didn't have a sliding swashplate, so I used a Robbe* modification kit to convert the swashplate into a "slider." For realism, the tail-rotor gearbox should be mounted so that it exits on the right side. This isn't a big problem because, for correct tail-rotor rotation with the double-sided main gear, you just mount the tail-rotor-

I flight-tested the Twin Star extensively before applying the scale dress.

SET-UP AND FLYING

The pitch settings on the head were set as follows: -2 degrees low stick; +4½ degrees half stick (five-eighths barrel opening on carb); +7 degrees full throttle.

When I had satisfactorily completed all the usual preliminary checks (including a radio-range check), I started the engine. Liftoff was at half-stick; and tail rotor and cyclic required slight trim corrections.

I had never flown a three-blade helicopter before, so I was quite surprised at the sensitivity of the head: every input to the head had to be neutralized with opposite input past the neutral point, or the helicopter would continue to fly on that initial input. With the exception of the tail rotor, I switched the rates to "low."

After a couple of tanks of fuel, I began to feel a little more comfortable. The machine was very stable in hover, and my only problem was "over-controlling"—my fault. Then, on final approach, with the Twin Star approximately at eye level, I lost transmission to the tail rotor, and this caused the Twin Star to pirouette. As I set it down, its tail skid struck the ground and broke the fuselage just in front of the tail-rotor gearbox bulkhead. Checking for damage, I found that the bolt that attached the rear of the fuselage to the mechanics had come out and allowed the tail-rotor drive wire to disengage from the front transmission. The causes?—normal vibration and an absence of Loctite* thread-locking compound on the screw (an oversight on my part).

I repaired the damage and reinforced the area with heavy fiberglass and resin. Then I reinstalled the gearbox, but this time, I installed the scale landing gear, which raised the tail skid. I also added an additional cooling fan (available from Schluter) to the clutch drum because, on the first test flights, the engine overheated. This isn't uncommon, especially in warm weather and with full-fuselage, scale helicopters.

I test-flew the Twin Star again and took some in-flight photos. All previous problems, including the overheating, had been resolved.

Forward flight requires forward cyclic to keep the nose down, and when going into a turn, you must keep the nose down or you'll see severe "ballooning." After the turn has been executed, you must add rear cyclic to maintain level flight.

After a few more tanks of fuel, I was more confident and felt more comfortable and aware of the Twin Star's flight characteristics. It flew quite nicely; with -2 degrees of pitch, approaches and descents were very scale-like.

As mentioned, the tail rotor response isn't strong, but it's perfectly adequate for scale-like flying. Flying this type of head takes some getting used to, so I wouldn't recommend it to inexperienced pilots.

driven gear on the underside of the main gear. (Holes are already in the side frames for this.)

I chose an O.S.* 61H long-stroke engine, a 925 Schluter muffler and a Futaba* 153BB gyro; and guidance is provided by a JR* Unlimited VIII radio with a Deans* base-loaded antenna. (This exits through the weather stripping on the observation window above the pilot.) The full-size machine is piloted from the right side and has only one set of controls.

A TWIN STAR IS BORN

First, I had to make the necessary cutouts in the fuselage for the windows, the mechanics, the air inlets, etc. For this, I used a Dremel* tool and an X-Acto hot knife—a combination that worked very well. I then installed just the windshield and the mechanics for the test-flight and photos. I wanted to check the radio operation and blade tracking and check for vibration, and I also wanted to see how the three-blade head would respond.

After flying several circuits, I was satisfied with the Twin Star's performance, so I disassembled it to begin detailing the fuselage.

PAINTING THE TWIN STAR!

First, to bring out any imperfections, I sanded the entire fuselage with 400-grit auto-body wet-and-dry sandpaper. The primers, paints, hardeners (Glasurit* products) and tapes I used are all available at your local auto-body store. The colors are urethane acrylics, not enamels.

The surface of the fiberglass fuselage was good, but there were numerous pinholes that I filled with 3M's Acryl Green Spot Putty, which dries quickly and is easy to sand. I also used it to fill the seam, and it took considerable time to achieve a smooth finish.

When I was satisfied with the finish, I lightly base-coated the fuselage with yellow to see whether I had eliminated all the holes and imperfections. This initial stage of finishing is the most critical and has the greatest influence on the finished product; so take your time and do it right.

To match the actual color of the full-size heli, I only had photographs to go by, but by looking at an automotive-paint color chart, I was able to mix the proper hues. I painted the entire fuselage, allowed it to dry thoroughly and then masked it before applying the second color.

After applying the yellow, I painted the red—again, referring to the photos for color lines and separation—a painstaking task. The most difficult job was the line on the vertical stabilizer's surface, which is ribbed. I used 3M's $^{1}/_{16}$-inch fine-line tape here.

When the paint had dried, I removed the tape and masking paper and then re-masked the already painted areas before applying the final color: orange. Again, I used the fine-line tape here and I applied three coats of paint. Before doing the lettering, I protected the paint with three coats of clear polyurethane.

For "SKYCAM"—the call letters on the top of the fuselage—and "Sterling," on the tail-boom, I used computer-drawn stencils. I drew the outlines on the surface and then hand-painted the words. I also used a stencil to write "Eyewitness News" under the doors and the call letters on the front, but this time, I used an airbrush. The fine lines on the doors and the front were also airbrushed.

After all this, I let the fuselage dry for two days, then I applied three more clear coats to seal the lettering completely and protect the helicopter's finish even more. Again, I let the model dry thoroughly before moving on to the final assembly.

FINAL TOUCHES

Next, I installed the remaining windows, adding miniature, rubber, window molding around them as an extra touch.

The fuselage kit included the basic interior details, e.g., the floor, the seats and the instrument panels, but I bought the pilot controls, the exterior antennas, the windshield wipers, etc., in kit form from Heli-Tech Designs* of Flushing, NY. I secured the interior to the front of the fuselage so that it can be removed when the front is taken off. This makes the mechanics accessible.

I started constructing my Twin Star on February 9, 1989, and the flight shots of the completed model were taken on April 6, 1990—a long time, but it was well worth the effort.

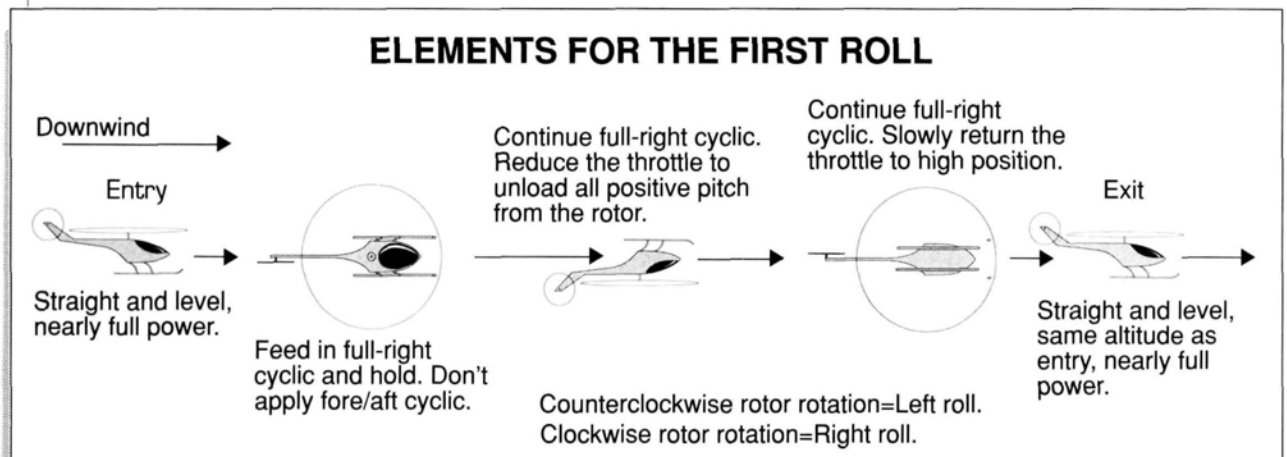
I thank Helen Hyker (at KYW-TV3), Richard Cavanaugh, Bill McCoursky and Brian Riddell for their time and assistance with this project.

Here are the addresses of the companies mentioned in this article:

Schluter; *distributed by Robbe Model Sport.*
Robbe Model Sport, *180 Township Line Rd., Belle Mead, NJ 08502.*
O.S. Engines; *distributed by Great Planes Model Distributors, 1608 Interstate Dr., P.O. Box 4021, Champaign, IL 61824.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
JR; *distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
Deans Connectors; *distributed by Ace R/C Inc., 116 W. 19th St., Box 511C, Higginsville, MO 64037.*
Dremel, *4915 21st St., Racine, WI 53406.*
Glasurit Products, *19855 West Outer Dr., Suite 401 East, Dearborn, MI 48124.*
Heli-Tech Designs, *144-31 68 Dr., Flushing, NY 11367.*
Loctite Corp., *4450 Cranwood Ct., Cleveland, OH 44128.* ■

Helicopter Challenge

by CRAIG HATH



Rolling right

IN THE LAST issue, I discussed the FAI schedule and how to perform the stall turn. As promised, this month I'll cover the ins and outs of performing the roll. The roll is part of the FAI schedule, and it's a basic maneuver, so I'll approach it from both perspectives.

Imagine yourself in the pilot's seat of a helicopter. You're in straight, level, forward flight at nearly full speed. As you push the joystick to the right, the helicopter tilts to the right, and the horizon appears to move to the left. As the heli rolls, you begin to ease up on the collective pitch, and you reduce the throttle in anticipation of the helicopter rolling upside-down. The ground is above you now, and you've reversed the collective pitch and re-opened the throttle to maintain normal rotor speed and to give the helicopter lift while it's on its back. You hold the right cyclic pitch, and the helicopter's nose rolls back to the opposite knife-edge position. To prevent the rotor speed from increasing excessively, you reduce the negative collective pitch while carefully reducing the throttle. The helicopter returns to the upright position as you ease the pressure on the right cyclic, re-open the throttle and increase the collective pitch. The maneuver is complete, and the heli is, once again, in straight, forward flight.

Whew! Of course, you're still sitting in your living-room easy-chair, but you probably feel a little disoriented. Full-size helicopters aren't equipped to execute rolls, but your model can perform them quite nicely—especially if it's set up properly.

MECHANICAL MUSTS

Certain control parameters will make this maneuver easier on you and your machine. First, it's important to set up the roll-cyclic throw so that the helicopter can complete the roll quickly. Don't overdo it. Just be sure that the response is enough to get you through the maneuver. If your machine only has Hiller rotor-head steering, i.e., cyclic-pitch control from the flybar only, with no main rotor-blade pitch mixing, you'll want as much throw as is mechanically possible. Even if your machine is equipped with Bell-Hiller mixing, i.e., flybar and main rotor-blade cyclic-pitch control, make sure that the weight of the stabilizer paddles and the main rotor-blades doesn't retard the control responses. Main-rotor-blade weight and flybar-paddle weight can greatly influence a helicopter's flight characteristics. Some models' instructions suggest the use of flybar weights for training and to improve hover stability. This will reduce roll-rate, so you'll have to find a happy medium.

ROLLING ROUTINE

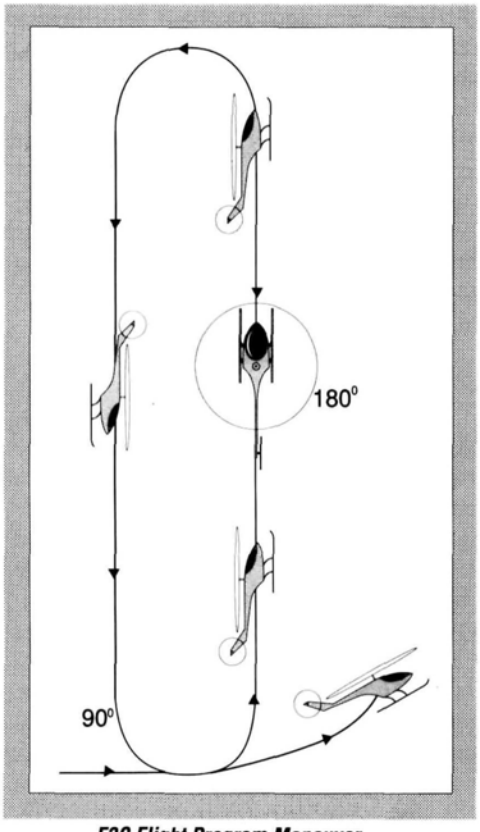
The best way to test the roll-rate is with the heli flying high in straight, level, fast, forward flight. Move the cyclic control stick to the full-right position, and hold it there until the helicopter rolls onto its back. When the helicopter is inverted, neutralize the cyclic pitch and then pull back on it until the heli is upright again. This shouldn't take more than about 2 seconds. On the other hand, the roll-rate shouldn't be so fast that the helicopter is uncontrollable. Use your judgement, and set the roll-rate so that you're comfortable with it. You

might want to set up the dual-rate feature of your radio system (if it's so equipped) for a nice hover in the low-rate position, and a snappy roll-rate in the high position.

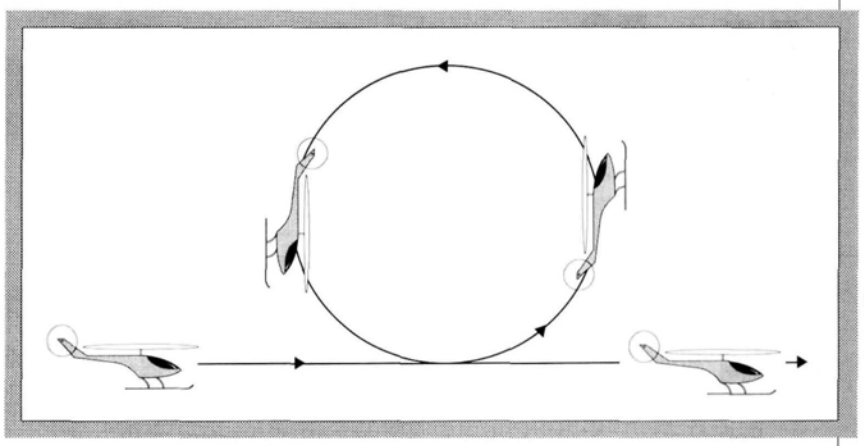
Another critical factor in executing good rolls is the location of the model's center of gravity (CG). If its CG is behind the main shaft, its nose will pitch upward during a roll. Add weight to the model's nose until its CG is about 1/4 inch in front of the main shaft. This will also improve the machine's overall performance and make most of its flight characteristics smoother and more predictable.

RADIO REQUIREMENTS

The final step to setting up your machine for rolls is influenced by your radio system's capabilities. Ideally, the collective pitch should be set up so that you can get enough negative pitch to lift the helicopter when it's upside-down. You also want the throttle to open enough to keep the rotor speed constant while the main-rotor blades are negative.



F3C Flight Program Maneuver No. 8—Rolling Stall Turn



F3C Flight Program Maneuver No. 6—Looping

I've been using the JR* PCM 10 radio in my helicopters for a couple of years, and I've been spoiled by the flexibility that this system allows. I'll outline the typical aerobatic setup that I use with the PCM 10 for most of my machines.

First, set the aerobatic pitch curve for the throttle/pitch switch number 1 (high-idle on some radios) so that the top end is the same as that on the normal pitch curve. This is the most pitch that the engine can handle at full throttle. Then, set the hover point so that the pitch is about 2 degrees less than the normal hover point at half stick. This provides a smoother transition from positive to negative pitch, and the collective doesn't feel "jerky" when you move the stick from the high to the low position. Set the low end of the pitch curve to the maximum amount of available negative pitch, but don't exceed the pitch that would bog down the engine.

Set the throttle curve so that the rotor speed remains constant, regardless of the throttle/collective stick position. The throttle is usually wide open when the stick is in either the high or low position. This setup enables you to roll the helicopter and fly it upside-down without switching into the inverted-flight mode. This setup is a "basic" of switchless, inverted flight, which I'll discuss in the future.

COMPENSATING FOR YOUR RADIO

If your radio system doesn't have the capabilities for this type of setup, your machine can still execute a fairly good roll if you follow as many of the steps as possible. If your system has a high-idle mode, you should be able to drop the collective pitch into negative while operating the throttle at a higher position than idle to prevent the loss of rotor speed. Just be careful not to open the throttle to the point where the rotor over-speeds as you make the transition from positive to negative pitch. Some radios will allow you a unique high-idle pitch curve and some won't. If your radio doesn't have a high-idle pitch curve, set up for about 2 to 3 degrees of negative main-rotor pitch with the stick in the low position.

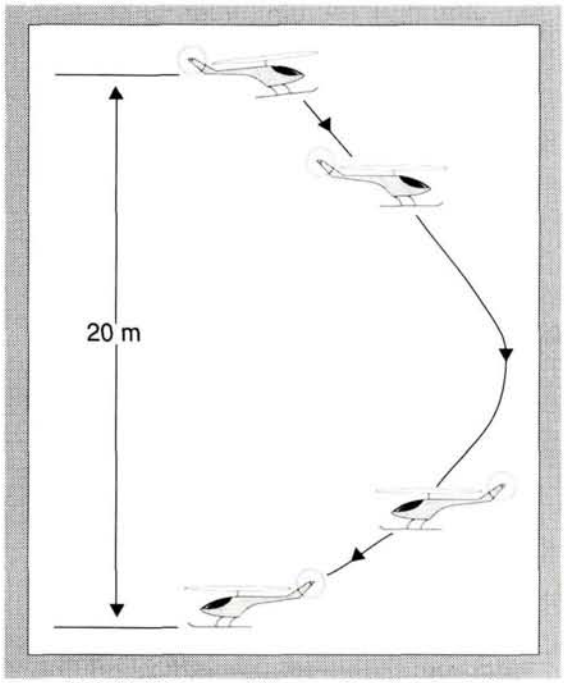
Fly the helicopter to check that there isn't too much negative pitch, which can make the heli hard to control during transitions from forward flight into hover. If your radio isn't equipped with any type of high-idle system, set up the pitch curve so that is has 2 degrees of negative pitch. When you're preparing for forward flight, advance the throttle trim to the full-high position. This will serve as a simple high-idle system, and it will help the heli to maintain rotor speed during the maneuver.

THE REAL THING

Now that your machine has been set up, it's off to the field to perform your first roll. Start with the helicopter high enough to recover from a mistake or two, but not so high that you can't see it well. Do your first rolls downwind and at a fairly fast forward air speed. If your helicopter's main rotors rotate clockwise (looking at them from the top), do your rolls to the right; if they rotate counterclockwise, roll to the left. This will allow you to work *with* the torque forces instead of against them. Start with the helicopter's nose level, and feed in the right (or left) cyclic pitch. Don't touch the fore/aft cyclic pitch unless it's absolutely necessary (you shouldn't have to if the CG is correct). To prevent the helicopter from losing altitude as it rolls onto its back, reduce the throttle stick to unload all the positive pitch from the rotor disk. Practice is the only way to get this part right, since all helicopters behave differently when upside-down. Continue holding the roll cyclicin until the helicopter rolls upright and, as it does, return the throttle to the high position. Exit the roll as you enter edit, flying straight and level.

The most critical part of the roll is when the heli is upside-down. If you try to

(Continued on page 75)



F3C Flight Program Maneuver No. 9—Autorotative Descent, 180-Degree Turn and Landing

ROTARY-WING ROUNDUP

ROBBE/SCHLUTER
Junior 50 II

Robbe/Schluter's smallest and hottest 50-size helicopter is now even better. The tedious job of building wooden servo trays is a thing of the past for owners of Schluter helicopters with System 88 mechanics. Like the Scout 60 and Magic 60, the Junior 50 II is now equipped with a plastic servo tray and a redesigned canopy. The new canopy has a sleeker, more aerodynamic shape, and it extends beyond the rear of the side frames to give the Junior II an entirely new look. The newly designed Junior 50 II canopy, matching bulkhead, and plastic servo tray are available as accessories for all existing Junior 50 helicopters.

Part no. S2876

For more information, contact Robbe Model Sport, 180 Township Line Rd., Belle Mead, NJ 08502.

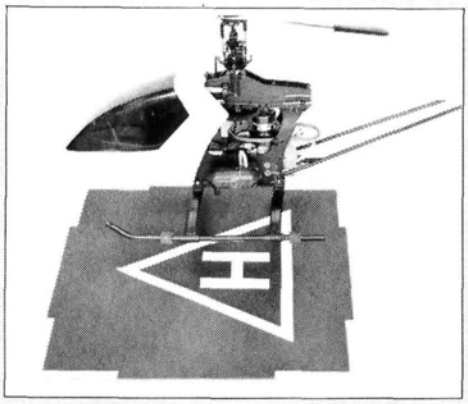
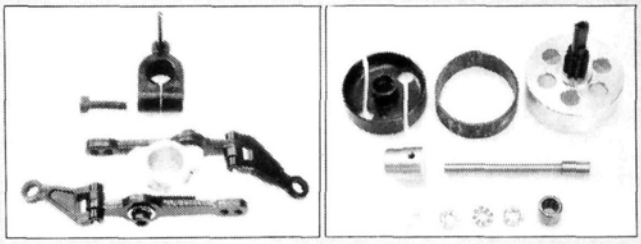


IMAGE PRODUCTS, INC.
Heli-Pad

Image Products, Inc. introduces the Heli-Pad—a multi-purpose pad for R/C helicopter pilots. It serves as a maintenance pad (its 20-inch-square magnetic surface prevents the loss of metal pieces), a starting pad (it keeps the helicopter free of dirt and scratches while at the field) and a practice pad (used as a reference tool when practicing autos, hovering, etc). The Heli-Pad is printed in easy-to-see neon orange. It's light, durable, has a non-slip backing, and can accommodate 30-to 60-size helicopters. The Heli-Pad is a must for R/C helicopter enthusiasts.

Price: $14.95 ($3.50 shipping and handling)

For more information, contact Image Products, Inc., P.O. Box 566125, Dallas, TX 75356.



ALTECH MARKETING
Hirobo Shuttle Parts

Hirobo and Altech Marketing are pleased to announce the availability of SE (Special Edition) parts for the Shuttle series of .30-size helicopters. Also known as "G" (for Gold) parts, these upgrade replacements enable Shuttle owners to achieve excellent performance and durability.

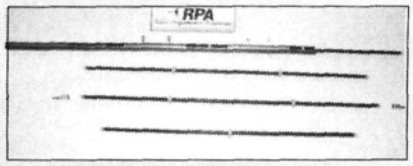
The SE W-Type Wash-Out Assembly will appeal to perfectionists. Quick input to the flybars and durability are the key results of adding this metal assembly.

With the SE Shaft Starter with Clutch Belt, there's no need to equip your Shuttle with a recoil starter or a rear cone-drive engine. This Shaft Starter set converts your Shuttle for use with a hex-shaft starter system (a non-slip, easy-to-start setup).

Part no. 0402-233 (SE W-Type Wash-Out Assembly)

Part no. 0402-247 (SE Shaft Starter with Clutch Bell)

For more information, contact Altech Marketing, P.O. Box 391, Edison, NJ 08818.



ROBBE/SCHLUTER Torque-Tube Drive Systems

Robbe/Schluter is proud to announce the first product in its new Robbe Performance Accessory line (RPA): the Robbe Torque-Tube Tail Rotor Drive System. Its components have been made with the closest tolerances available in the industry. This new drive system features precision ball bearings pressed directly onto the tube to eliminate the need for a bushing. The bearings are held in exact alignment in the tail boom by O-ring retainers that snap into place over them. Because the retainers snap on, there's no slippage. The Torque-Tube itself is 8mm in diameter and is made of an epoxy/glass combination that allows the fibers to be wound in both directions, thus avoiding a torque or anti-torque direction. Shown are the Magic, Champion, Scout and Junior 50 Torque-Tube drive systems.

For more information on this and other fine Robbe Performance Accessories, see your local dealer or contact Robbe Model Sport, 180 Township Line Rd., Belle Mead, NJ 08502.

GREAT PLANES MODEL DISTRIBUTORS Hughes 500 Heli Body for EP Concept

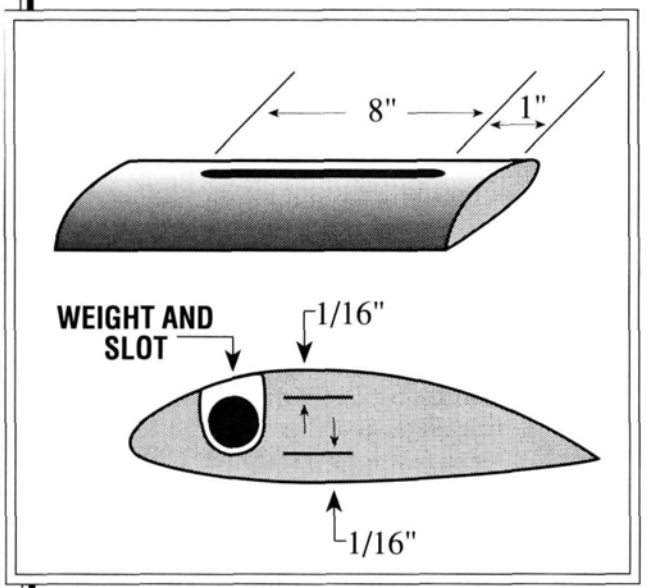
Add scale realism to your electric helicopter! This new Hughes 500 helicopter body for the EP Concept is made of the same light, durable, polypropylene plastic as the original Concept 30 heli body. Decals are included.

For more information, contact Great Planes Model Distributors, 1608 Interstate Dr., P.O. Box 4021, Champaign, IL 61824.

MOVING THE CHORDWISE CENTER OF GRAVITY

by PAUL TRADELIUS

IN THE JANUARY '91 issue, I discussed the effects of changing the chordwise CG of rotor blades and told you how to check it. This month, I discuss ways to move the chordwise CG forward; you hardly ever have to move it backward—i.e., toward the rotor-blade's trailing edge. I can think of only one circumstance in which the chordwise CG might be too far forward: if the blades were originally weighted for use on a flybarless rotor head, but these blades were used on a head with a flybar. Flybarless blades have their CG well forward, but they also work on a flybar head. They actually provide a stabler, steadier performance, but they're so stable that their aerobatic capabilities are poor.



Starting 1 inch from the blade tip, mark an 8x3/16-inch "box" that's positioned to allow 1mm of the blade material above and below the solder weight when it's installed.

SAFETY FIRST

There are many good, safe, commercial rotor blades at your hobby shop. When you modify your heli's rotor blade (or anything else on it), you could make it unsafe if your changes exceed its design limits. *You must take the responsibility for any modifications you make.*

COMMERCIALLY WEIGHTED BLADES

Because of these safety considerations, if your chordwise CG has to be moved forward, it's best to buy another set of rotor blades—ones specifically manufactured with the chordwise CG in a more forward location. Most rotor blades are made with a harder, heavier wood for their leading edge and a lighter wood for their trailing edge. This, in itself, may be enough to give blades the needed forward CG.

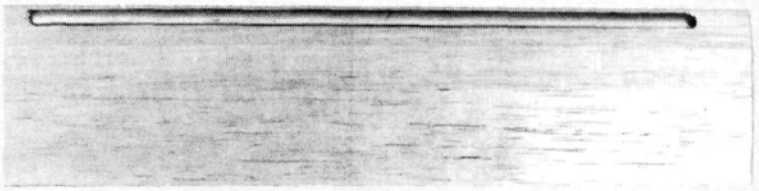
There are also manufactured weighted blades that have the chordwise CG further forward. Weighted blades also have more mass, so they're more stable and offer better performance. Miniature Aircraft USA* and Yale Hobby Manufacturing* produce excellent weighted blades. Check with your dealer to see what's recommended for your particular helicopter.

WEIGHTING YOUR BLADES

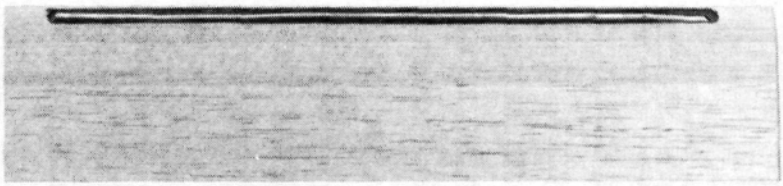
Suppose you already have a perfectly good set of new, un-weighted rotor blades with a

A SAFE, EASY WAY TO IMPROVE ROTOR STABILITY

MOVING THE CHORDWISE CENTER OF GRAVITY



The rotor blade has been routed out as close to the leading edge as possible to accept the solder weight.



The solder has been rolled flat and put into the slot, ready for the epoxy and balsa capstrip.

The finished rotor blade. To preserve the blade's appearance, the slot is on the bottom. A paste of epoxy and microballoons can be used to fill the slot.

PHOTOS BY PAUL TRADELIUS

chordwise CG that's too far back and you'd like to do a little experimenting. The following technique for 60-size rotor blades has worked well for me from the standpoint of performance and safety. This modification adds about 20 grams to each blade, and it moves the CG forward about 5 to 10 percent.

You'll need two *identical* 8-inch pieces of commercial-size, solid-core, 1/8-inch-thick solder. If both pieces aren't exactly the same weight, when you add them to your blades, the blades will be severely out of balance. Weigh each piece, and file the heavier one until they weigh the same. Use a router or a drill press to make a slot in each blade. The solder will go into these slots; the question is where to make the slots.

• **Spanwise position.** To improve autorotations and the dynamic stability of the rotor disk during hovering, place the weight as close as possible to the blade tip, but not so close that there's insufficient blade material to prevent the weight from flying off the end. I always start each slot about 1 inch from the tip; so far, this has worked well.

Draw two chordwise lines across the bottom leading edge of the rotor blade at 1 inch and 9 inches away from the blade's tip. I always mark and cut the rotor blade on the bottom so that the marks don't show, but you can work from the top of the blade if you're careful with the final finishing.

• **Chordwise position.** Because it's almost impossible to move the chordwise CG too far forward, I always cut the slot as close to the blade's leading edge as possible. It's easy to find this chordwise position if you measure the rotor blade's thickness at its tip. Then, find and mark a position near the leading edge that's about 2mm thicker than the solder wire so that, when the solder weight is installed, there will be a minimum of 1mm of wing material above and below it. That point marks the forward edge of the slot. This edge of the slot can then be "transferred" to the bottom of the blades, as a line is drawn between the 1- and 9-inch points measured before. If desired, another line can then be drawn to show the slot's trailing edge, and it will also define the "box" in which the weight will lie.

It's easy to set the depth of the router or drill press so that 1mm of wood is left on the blade's top. To ensure an accurate job, clamp a spare piece of straight wood to the rotor blade to act as a "fence" that guides the rotor blade while the cut is being made

Once the slot has been made, a mixture of epoxy and microballoons or talcum powder makes a nice paste with which to hold the weight in position. This mixture should be thick enough to stand on its own until the epoxy has cured. Pour a little of this mixture into the slot, and then press in the weight so that the excess epoxy mixture can be sanded easily with a sanding block and 80-grit sandpaper. When you sand off the excess epoxy, don't sand the wood or you'll change the shape of the rotor blade's airfoil. To make sanding easier, you could also epoxy a small balsa capstrip over the weight.

If this procedure is done accurately on both blades, their chordwise and spanwise CG and overall balance should still be the same. If the blades' spanwise CG is "off" slightly, check the balance to see which is the lighter blade. To move the CG in the desired direction, add a small amount of epoxy to the underside of the lighter blade. I like using epoxy for this job because it's fairly heavy, it's easy to smear for a smooth finish, and it cures rather than dries, so its weight remains the same.

I'm sure there are other techniques, but I've always found this method easy and accurate. It takes a little practice to get the feel of things, but now I can weight a set of blades in about 30 minutes, and that includes the curing time for the 4-minute epoxy. Try it; you'll like it.

**Here are the addresses of the companies mentioned in this article:*
***Miniature Aircraft USA,** 2324 N. Orange Blossom Trail, Orlando, FL 32804.*
***Yale Hobby Mfg.,** 3896 Selvitz Rd., Ft. Pierce, FL 34981.* ■

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ENGINES: Ignition, glow, diesel. New, used, collectors, runners. Sell, trade, buy. Send SASE for list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

COMPUTERIZED AIRCRAFT PLOTS: Technical illustrations suitable for framing. Three-views. Computer scale drafting and scanning services. Turn old prints into masterpieces! Catalogue, $1. D-TECH SYSTEMS, Rte. 2, Box 191-14, Carterville, IL 62918.

BERKELEY, CLEVELAND, ETC., replica kits, duration rockets for jet models. Send two stamps to: WILLAIRCO, 2711 Piedmont Rd. NE, Atlanta, GA 30305.

HARDWARE, SOCKET-HEAD CAP SCREWS @ excellent prices. Example: alloy socket-head cap screws 4-40x1/2, $4.15/100; or stainless, $5.95/100. For free catalogue, write to Micro Fastners, 110 Hillcrest Rd., Flemington, NJ 08822; or telephone (908) 806-4050.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

WANTED: MIDWEST A-4: any condition (even wrecked!). Also, any other ducted-fan planes, kits, plans, accessories, or wrecks. Please call with details. Chris, (918) 663-7847 or 743-0637.

DC-3 RETRACTABLE landing gear (electric) for Ziroli and Ziroli DC-3 plans. $250. Excellent condition! Garry Kravit, 163 NW 98th Terrace, Plantation, FL 33324. Tel.: (305) 370-9539.

SALE: MODEL MAGAZINES, 1960+ *Model Airplane News, American Modeler, Flying Models, Model Builder, RCM.* Most under $3, SASE. Milton Sheppard, 670 Concord Rd., Glen Mills, PA 19342.

WANTED: I will buy your old, outdated R/C systems. Ron Gwara, 21 Circle Dr., Waverly, NY 14892. Tel.: (607) 565-7486.

ELECTRIC FLIGHT EQUIPMENT—*We cater to the electric flier.* The best and largest electric flight supply in the Northeast. Specializing in *AstroFlight* equipment. Kits, motors, batteries and lightweight building supplies plus everything else you need for electric flight. Send $5 (USA), $6 (foreign) for catalogue to CS FLIGHT SYSTEMS, 31 Perry St., Middleboro, MA 02346, or call (508) 947-2805 to order; Visa and Mastercard.

BUILD YOUR OWN electronic accessories. Complete instructions and diagrams for servo driver, battery tester, low-battery alarm, chargers, speed controller, etc. Send check or money order for $9 plus $2 S&H to: Walter Donaldson, 708 Hall, #443, Eldorado, TX 76936.

CHINESE HOBBY PRODUCTS: Large variety; good quality, but cheap. $3 for catalogues. John Zheng, 739 Valley View Dr., River Falls, WI 54022.

1930s to 1950s MODEL AIRPLANE MAGAZINES: 1930s aviation pulps, complete and good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

7-FOOT & 11-FOOT WINGSPAN—BV138 German, three-engine flying-boat, precision-scale plans. Five sheets (7 1/2x3 feet). Details and photo for two stamps. Gene Falada, 22W070 Byron Ave., Addison, IL 60101.

FOR SALE: Florida hobby shop; profitable business specializing in R/C. For info, write to 1808 Catawba St. Columbia, SC 29205.

SCALE DOCUMENTATION, PLAN ENLARGING. 88 super-scale, giant, sport R/C construction plans; three-views; cutaway drawings; 85,000 documentation photos in stock; 125-page catalogue, $5 ($9 overseas). Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403. Tel.: (919) 292-5239. Visa, Mastercard.

CASH OR TRADE for your old model-airplane ignition engines, parts and collections. Detailed, exact 1/4-scale plans: Piper Tri-Pacer PA-22, Aeronca-K, DH 80-A Puss Moth, D-85 Leopard Moth; all for $100 or $29.95 each. Exact 1/5-scale plans: J-3 Cub, PA-12 Super Cub Cruiser, Aeronca-K, Piper Tri-Pacer; all for $80 or $24.95 each. Send $1 and large, stamped SAE for the latest bulletin. Carl Miller, 130 Yucca Dr., Sedona, AZ 86336.

PRECISION SCALE WHEELS & TIRES. Custom-designed aluminum wheels, sand-cast spokes for WW II aircraft. *New, lighter tires.* Each set is not only the scale size for your individual aircraft, but it's as scale as possible in every respect. Custom orders are accepted for any aircraft. Pneumatic brakes available. *Available now:* F-105 1/10-scale and the F-100 1/10-scale: semi-kit, $239; complete kit, $339. Also available: struts, retracts and scale wheels and tires for all kits we manufacture. *Coming soon:* A-10, MiG 29 and F-18. For more details, call or write Glennis Aircraft, 5528 Arboga Rd., Linda, CA 95901; (800) 688-3957 or (916) 742-3957.

PAYING $40 EACH for toy, metal, electric, outboard boat motors: Oliver, Gale, Johnson, etc. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684-2802.

MUST SELL: Collection of 26 airplanes; 1/3- and 1/4-scale with radios, twins, 4-strokes, some scale winners, etc. Send SASE for info ($2 for pictures). M.A. Pittman, 3991 Steinhauer Rd., Marietta, GA 30066.

CANARDS—full-size plans for 1/4-scale "Quickie" or "Canard Stick"; $10 each, postpaid. Charles LaBelle, N2147 Pine Beach Rd., Oostburg, WI 53070. Phone/Fax: (414) 564-3619.

START YOUR OWN HOBBY SHOP or buy for friends or group; 30 to 60 percent off. For information, send $1 and no. 10 SASE: R&L HOBBIES, 8620 S. Westnedge, Portage, MI 49002.

STUNNING ACTION VIDEO and perfect aerials *from your plane!!!* Build our 4-ounce, 2 1/4x4-inch color TV transmitter for under $80. Complete, 37-page plans only $9.95. Satisfaction guaranteed; $3 and S&H. We also have *a "cigarette-pack" size, 4-ounce minicam!* SUPERCIRCUITS, 1403-B Bayview, Hermosa Beach, CA 90254; (213) 372-9166.

WANTED: kits from 1950s and '60s, especially: Monogram, Berkeley, Speedee-Bilt, Babcock, Veco, Scientific U/C, deBolt, Top Flite, Taurus and Tauri. Dr. Frank Iacobellis, 15 Highland Park Pl., Rye, NY 10580; (914) 967-5550.

ADVANCED MODEL ROCKET KITS: scale, futuristic and sport rockets; 1.5- to 4-inch diameter and 19 to 67 inches long. Catalogue, $2; THOY, Department AN61, P.O. Box 467, Ypsilanti, MI 48197.

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

PLANS ENLARGED, Large Scale Specialists. PC Model Software. Free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

GIANT SCALE PLANS by Hostetler. We fly what we draw. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

SCALE MODEL RESEARCH Aircraft Documentation. World's largest. Over 3,000 different Foto-Paaks and 10,000+ drawings. Catalogue $4. 2334 Ticonderoga, Costa Mesa, CA 92626 (714) 979-8058.

WANTED: Old unbuilt plastic model kits. Planes, military, figures, cars, promos. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192.

INTERNATIONAL AIRCRAFT RESEARCH— Need documentation? Include name of aircraft for availability of documentation with $3 for 3-view and photo catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

HELICOPTER SCHOOL: 5 days of hands-on instruction with X-Cell Helicopters and Futaba computer radios. Small classes, tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 80 satisfied students and 2,600 flights logged in our first 8 months of operation. Located on a 67-acre airport used exclusively for R/C training. Owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Winter and spring classes run January 7 through June 21. Write for free information and class schedule *now* to R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (904) 698-4275.

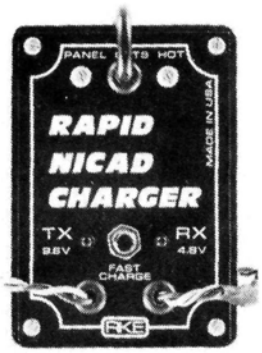
USED ENGINES WANTED—Ignition, glow, diesel. Send description and price for prompt reply. T.Crouss, 100 Smyrna St., West Springfield, MA 01089.

EMBROIDERED EMBLEMS, enamel pins. Your design; excellent quality; free booklet. A.T. Patch Co., Dept. 68, P.O. Box 682, Littleton, NH 03561. Tel.: (603) 444-3423.

R/C WORLD—ORLANDO, FL, CONDO RENTAL—2 bedroom, furnished. Available weekly or monthly. Low rates, 100 acre flying field with enclosed hangar. Swimming pool, tennis courts on site. Minutes from Disney World and Epcot Center. For information, call Joan, (800) 243-6685, or write to Air Age, Inc., Condo Dept., 251 Danbury Rd., Wilton, CT 06897.

PRODUCT NEWS

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by Model Airplane News, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in Model Airplane News.



RK ELECTRONICS
Rapid Nicad Charger

Using state-of-the-art Mosfet technology, the RK Electronics Rapid Nicad Charger can rapidly field charge your 4.8V or 6.0V receiver and 9.6V transmitter Ni-Cds, simultaneously or independently. Plug the included adapter into your cigarette-lighter socket, push the button, and this unit will charge to 100-percent capacity without the car engine running. Separate receiver and transmitter current adjustments of up to 1000mA (factory set at 500mA) allow both fast charging of Ni-Cds with capacities in excess of 1000mAh and the convenience of home use.

Price: $66.95

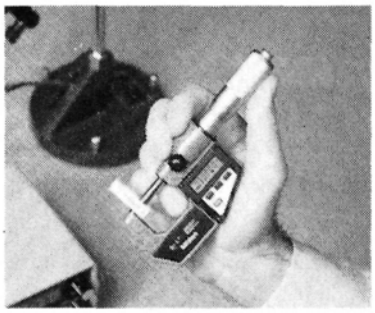
For more information, contact RK Electronics, 304 Fox Run, Hudson, NH 03051.

BANNER AIRCRAFT DESIGNS
Sukhoi SU26M

Banner Aircraft Designs has announced the release of its new Sukhoi SU26M, in a 1/5 sport-scale kit. Its features include a hand-laid epoxy/glass fuselage, cowling and belly pan; a clear Lexan canopy; bent and rolled 6061 T-6 aluminum landing gear; and custom-cut foam-cores for the wing, ailerons, stabilizer and elevator. The Sukhoi's wingspan is 66 inches with a root chord of 16 1/2 inches and a wing area of 883 square inches. It's 59 inches long, and the recommended engines are .90 to 1.08 2-stroke or a 1.20 4-stroke. All wooden parts are machine-cut from birch aircraft plywood.

Price: $225 plus S&H

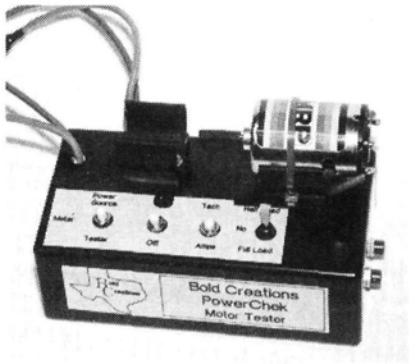
For more information, contact Banner Aircraft Designs, 5717 Sullivan Trail, Nazareth, PA 18064.



MITUTOYO
New Digimatic Micrometer

Mitutoyo's Digital Micrometer is the top-of-the-line instrument for building or replicating models. Designed with the hobbyist in mind, the micrometer's large LCD readout allows easy-to-read measurements at the touch of a button. Because of its inch/millimeter push-button control, measuring is universal with the Digimatic Micrometer; it's like having two micrometers in one. It's accurate up to 50 millionths of an inch and will fit comfortably in the palm of your hand.

For more information, contact Mr. William Gazdag, Advertising Manager, Mitutoyo/MTI National Headquarters, 18 Essex Rd., Paramus, NJ 07652.



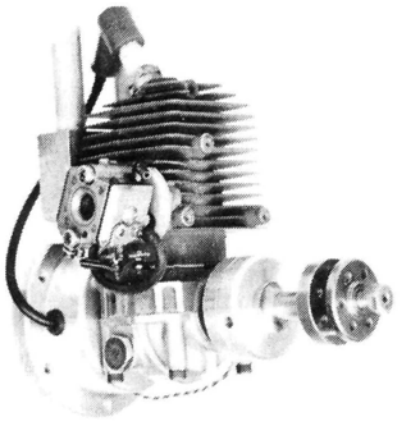
BOLD CREATIONS
PowerChek™ Motor Tester

The latest product from Bold Creations is the PowerChek™ motor tester. This one-piece unit contains a built-in generator and is designed to make motor testing easy for electric-flight enthusiasts. The PowerChek™ is calibrated to measure real rpm, motor current *and* power source voltage. It provides three load conditions: no load, half load and full load. In this way, the user can find the true performance of motors under operating conditions similar to those in the models. A voltmeter and a power source (which could be a battery or a power supply) are the only additional equipment required. The PowerChek™ is small enough to fit in most toolboxes so it can be taken to the field to "tune" motors for peak performance.

Price: $85

Part no. BC034

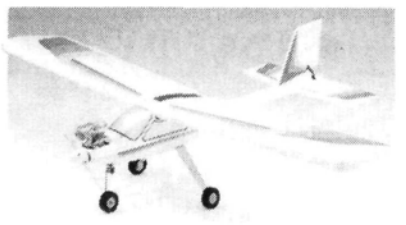
For more information, contact Bold Creations, 1305 Abbey Rd., Round Rock, TX 78681.



R.C. IGNITION
C.D. Ignition Conversion

Available now from R.C. Ignition are its new C D Ignition Conversions. The advantages of a C D Ignition include: an easier-to-start engine, no need for a spring starter, a weight reduction, and the removal of the coil and flywheel to promote easier engine cowling. The ignition circuit is contained in the engine mount, which is custom-machined from solid-aluminum bar stock. Special attention is given to every conversion. Each engine is tuned for superior timing, which accounts for excellent starting and running. The ignition circuit will be replaced free by R.C. Ignition if it ever fails. R.C. Ignition is currently converting the Zenoah G-23, the G-38 (shown) and the G-62, and the Sachs 3.2, 4.2 and 5.2. Other engine conversions will be forthcoming.

For more information, contact Ralph Cunningham, R.C. Ignition, 16845 North 28th Ave., #1434, Phoenix, AZ 85023.

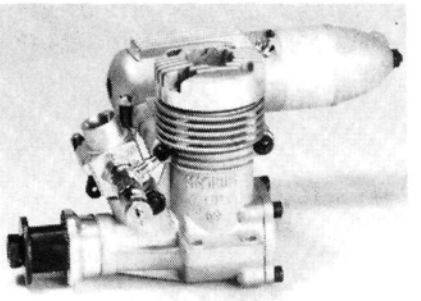


GREAT PLANES MODEL DISTRIBUTORS
Flitecraft's Minuteman 40

The hardest thing about building Flitecraft's new, durable, Minuteman 40 trainer is waiting for the glue to dry! With only six major pieces, the Minuteman requires just four to six hours of easy assembly. An enclosed cowl provides realistic looks that no other durable trainer can match, and that makes training flights even more enjoyable. The Minuteman is also designed for easy maintenance and repair. Ailerons are installed for aerobatic potential, and pushrods, clevises, an engine mount and landing gear are all included in the kit.

Price: $99.95

For more information, contact Great Planes Model Distributors, 1608 Interstate Dr., Champaign, IL 61820.



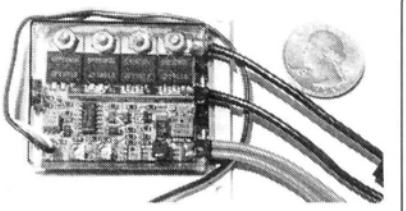
GLOBAL HOBBY DISTRIBUTORS
Magnum GP.15 ABC/FSR Aircraft Engine

Designed for smaller aircraft and $^{1}/_{10}$-scale gas cars, these Magnums fill the current need for high-quality, reliable, small engines. Equipped with such high-performance features as: front-rotor Schnuerle porting; chrome-plated brass cylinders; aluminum-alloy pistons; precision, bronze, Oilite bearings; reverse-cone, adjustable, exhaust-deflection mufflers with noise-reduction chamber, and twin needle adjustment carburetors.

Price: $72.95

Part no. 213215

For more information, contact Global Hobby Distributors, 18480 Bandilier Circle, Fountain Valley, CA 92728.



JOMAR PRODUCTS
SM-4 Control

Jomar Products is proud to announce the latest addition to its line of electric motor speed controls for aircraft. The SM-4 control is now available with heat sink, see-through polycarbonate plastic protective cover, Sermos connectors and a Futaba "J" lead standard. The SM-4 is a "high-rate" throttle for minimal motor heating, and it features "up-front" optical isolation to reduce radio interference from the motor control system. Designed specifically for motors in the 05- to 40-size range, the SM-4 can handle from 7 to 21 cells at currents up to 50A continuous. Its surge current rating is 200 amps.

For more information, contact Jomar Products, 2028 Knightsbridge Dr., Cincinnati, OH 45244.

MIDWEST PRODUCTS CO., INC.
Midwest Easy Trim

Midwest Easy Trim is a new line of pressure-sensitive graphics that gives beginners or experts professional results in very little time. In less than two hours, you can have a beautiful multi-colored model. There are four unique designs from which to choose, and neon colors are available. Each package contains two 12x26-inch sheets that are designed to decorate models with wingspans of from 40-70 inches. Midwest Easy Trim is fuel resistant and can be applied to any iron-on covering material or painted surface.

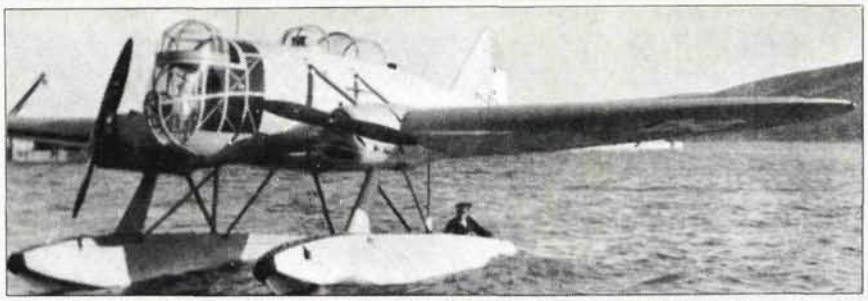
Prices: $18.95 to $19.95

For more information, contact Midwest Products Co., Inc., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to Model Airplane News, **Name that Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



Congratulations to Richard W. Gleason of Austin, MN, for correctly identifying the Abrams Explorer in the April issue. Rich's answer was chosen from the 40 correct replies we received.

The Abrams Aircraft Corp. was formed in 1937 to build the Explorer for aerial survey work. The two-seat, highly specialized airplane was designed for high speeds and a rapid rate of climb, and to allow its pilot exceptional forward and downward visibility. The supercharged 365hp Wright Whirlwind R-975-E.1 air-cooled engine gave it a cruising speed of 175mph at 10,000 feet and a maximum speed of 200mph at 10,000 feet. Its twin tail booms and rudders gave the Explorer excellent control at very low air speeds, and it could land at 60mph with flaps. For its high-altitude mapping and survey work, the Explorer could remain aloft for 8 hours, and it was equipped with an oxygen system for its crew. Its wingspan was 36 feet, 8 inches; it was 26 feet, 6 inches long and 6 feet, 4 inches high; its gross weight was 3,400 pounds. Its service ceiling was 20,000 feet and it had a range of 1,200 miles. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

TINGALPA MODEL AERO CLUB, INC.

c/o Ian K. Gillespie, 7 Sydney Street Fairfield,
Brisbane, Queensland
Australia 4103

Aero modeling is alive, and doing very well Down Under. The newsletter sent to us by the Tingalpa Model Aero Club is full of interesting Aussie facts and shows us how seriously our Australian counterparts take their hobby. Editor Ian Gillespie puts out more than a newsletter! It's geared to generate enthusiasm and motivate the club's members while remaining entertaining and informative.

In an effort to draw hobbyists closer and make newsletters all over the world more interesting to read, Mr. Gillespie has invited all *MAN* readers to write and to exchange their clubs' newsletters with his. We encourage our readers to get involved; send these modelers a note and get acquainted!

The list of this club's coming events, which include Warbirds Day, Old Timer's Vintage Day, Race Day, Sailplane and Electric Day, Biplane Day, Unusual Model Day and a Fun Fly, reflects a wide range of interests. The T.M.A.C.'s year-round flying season allows its members the opportunity to enjoy a large and varied schedule of activities

Safety is very important to this club, and its members take great pride in the flight school run by Ray Dixon, the club's chief flight instructor. A full page of the newsletter congratulates recent graduates of the program and welcomes them into the ranks of accomplished fliers. "Fly with a purpose," Mr. Dixon reminds members in his newsletter column, "Ray's Ramblings." Ray dispenses detailed do's and don'ts, and he explores a range of topics, including the importance of practice landings and what to do when you have a "dead-stick." We think that having a flight instructor is a great idea—one that promotes and encourages the growth and safety of the hobby. Every club should consider appointing one.

For their safety awareness, optimism and desire to correspond with hobbyists worldwide, we're sending two free Model Airplane News subscriptions to our newest "Club of the Month." No worries, mates! ■

ADVERTISER INDEX

MODEL AIRPLANE NEWS

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the **Model Airplane News Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You will have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address, and telephone number.

HOBBY SHOPS: Act now and get first ad free!

Directory space is sold on a yearly basis with a choice of three payment plans: 1. $179 per year, payable in advance; 2. $97 for six months, payable in advance; or 3. $17.50 per month to be billed monthly. Space reservations must be received by the 10th of the third month preceding publication (for example, January 10th for the April issue).

ALABAMA—Huntsville

4.5 miles east of the Alabama Space and Rocket Center. Complete line of Radio-Control, Free-Flight, and Control-Line Airplanes and Hardware, HO&N Scale Trains, Rockets, Ships, and Plastics. Hours: Mon-Fri, 9-6; Sat, 8-5; Sun, 12-5. Daily UPS pickup.

WILSON'S HOBBY SHOP

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Your one-stop R/C shop. We try to carry it all. Major items discounted. Help and advice free. Building and bull sessions allowed on premises. Near LAX. Owner: John Eaton.

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Connecticut's leading R/C shop, 15 years experience flying and selling radio control. Over 3,500 different items in stock. Custom ordering for hard-to-find parts.

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- UPS orders shipped daily
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Chicago's largest hobby shop. R/C planes, helicopters, boats, and cars. R/C Repairs, installations, and custom building. Mon.-Fri. 10-9; Sat. 9-6; Sun. 11-4.

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R/C Helicopters: Concept, Schluter, Parts & Accessories
R/C Cars, Boats, Parts & Accessories
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Findlay's local R/C dealer, planes—cars—boats. We specialize in R/C, large selection of kits, accessories, and parts. We are authorized Sig and Dremel dealers. Also sell plastic kits and model rockets. Tue. & Thu. 3-9, Mon., Wed., Fri., & Sat. 10-9.

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R/C Specialists, planes, helicopters, cars and boats. We also have kites, boomerangs and plastics. Experienced personnel to answer all your questions. AE, Visa, MC. Hours: Mon.-Sat. 9-7, Thurs.,Till 8.

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5241 S. Peoria Ave. **(918) 745-0034**

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COSTA RICA—San Jose

Complete line of R/C airplanes, cars, boats, and helicopters. Parts and professional expert service and advice. Julio Pastura, President. Weekdays 4-10 p.m.

EL HOBBY SHOP

Centro Commercial, San Jose 2000
Apartado 529, Centro Colon **32-26-81**

Send sales message and payment to
Model Airplane News Hobby Shop Directory,
251 Danbury Rd., Wilton, CT 06897.
For further details or information on our special introductory offer, call toll-free 1-800-243-6685 and ask for Laura Kidder.